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DEPARTMENT OF AGRICULTURE

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TANGANYIKA

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INTRODUCTION

AGRICULTURAL POLICY

The chief aim of the agricultural policy is to achieve self-sufficiency in the important staple grain crops and pulses, providing in some instances an exportable surplus to make up deficiencies in other East African territories. In balance with this programme the objective is to encourage, extend and improve the cultivation of the main export crops, in particular sisal, cotton, coffee, pyrethrum, tobacco and oilseeds. Until the mineral deposits of the Territory become more intensively exploited, the wealth and standard of living of the people must depend almost entirely upon the scale of agricultural exports.

In order to attain these ends the maintenance and improvement of soil fertility, the control of soil erosion, plant protection from pests and disease, and the use of agricultural machinery must all play their part, and they consequently take a high place in both the investigational and extension work of the Department.

In addition to major projects two minor branches of production, fish farming and beekeeping, have recently received a great impetus from the promising early results of development schemes. At the same time the possibilities of developing crops which are at present of little importance and the introduction of new crops are not overlooked.

WEATHER AND GENERAL REVIEW

1950 will stand out in history as being the first year of the present era in which the Territory produced sufficient grain for its own needs, and this was accomplished in spite of low yields in the Tanga, Western and Southern Provinces due to badly distributed rainfall.

The year started with a serious carry-over of famine relief resulting from the disastrous drought of 1949, but early-sown maize and pulses soon began to relieve the situation, and with good growing conditions over most of the country some excellent harvests were obtained. It is, however, a matter of some concern that local production of groundnuts and mixed beans was insufficient to meet the needs of fed labour, and considerable quantities of each were imported. An appreciable portion of the bean surplus did not find

its way to the main markets at all, but was disposed of at enhanced prices to large employers of labour and also across the Belgian Congo frontier.

As so often happens a good grain year proved to be a poor cotton year, and although a large acreage of cotton was planted yields suffered from untimely rain, from insect pests, from rat damage and in some places from apathy on the part of the growers.

In the Southern Province dull, overcast weather during the ripening period reduced the grain yields very appreciably, and in the Southern Highlands late harvested maize had to be dried off in the pyrethrum ovens. In the north, mists and drizzle just cleared up in time to ensure a good harvest.

One of the features of the year was the steady and, in some cases, phenomenal rise in the prices of export crops; but these increases had not yet been passed on to the prices of imported consumer goods which are manufactured from raw materials, nor were larger quantities of merchandise available in the shops to absorb this additional purchasing power. It is therefore by no means improbable that reduced acreages will be planted during 1951, in spite of the fact that the controlled prices for maize, beans and groundnuts have been increased, and that intensive propaganda was carried out at the end of the year.

Another feature of the year was the gradually increasing interest being displayed on all sides in the use of agricultural machinery. This aspect has now reached such a stage of development that a separate section of this Report is devoted to it.

In the Lake Province the scheme to intensify extension work by a larger than normal concentration of staff on the ground gained momentum. Half the staff of Agricultural Assistants was recruited (seven posts out of fourteen approved), and many of the new Instructors completed their short training course and began work in the field. The more regular presence of an Instructor in a small community of cultivators is already producing interesting problems in human relationships.

ESTATE AGRICULTURE

The production of export crops on estates and non-native farms is given in the table which follows. Comment on individual crops has been reserved for that section of the Report.

Estate Crop Production is as follows:

	1949		1950	
	Production tons	Value £	Production tons	Value £
Sisal	123,296	10,342,036	121,598	11,846,057
Coffee	1,647	199,836	2,264	—
Tobacco	1,073	217,536	1,278	256,376
Tea	427	69,700	780	218,400
Pyrethrum ...	141	26,150	293	65,610
Sugar	—	—	8,188	—
Papain	119	91,804	5	—
Seed Beans ...	1,655	—	1,401	—

As the year wore on labour difficulties which had been acute at the outset became even more pronounced. With the rising tempo of the development programme the demand for labour for public works, for building construction, for food production and for the transport services is becoming more and more intense. Added to this, higher wage rates in some areas have proved to be more of a deterrent than an encouragement because the cash needs of the individual labourer can be met by fewer days work. The report of the Committee set up to report on the utilization of the manpower of the Territory will be awaited with great interest.

The high prices which had to be charged early in the year to employers of labour for meal made from imported grain acted as a strong inducement to estates, particularly those planting sisal, to grow as much of their requirements as possible on their own land. Some very fine crops were harvested, especially in the Kilosa and Luengera areas; in the former, one estate using seed imported from Moshi reaped 9.8 bags per acre interplanted with sisal at a two-thirds stand, compared with an average of 5·5 bags from the customary "Kenya Hybrid" seed.

The development of farms recently alienated to Asian planters in the Eastern Province was somewhat disappointing. Progress was rather slow and the cropping system was not as sound as it might have been. The great importance of plant sanitation has not yet been properly understood by many of them, and for at least a year or two there will be a real danger of serious damage from insect pests. No doubt prolonged propaganda, coupled, it is hoped, with the infiltration of trainees from the Indian Agricultural School at Morogoro, will eventually overcome these teething troubles.

AFRICAN AGRICULTURE

In many parts of the country the lessons of the 1949 drought and famine have been driven home. In the Central Province particularly, local grain storage schemes by means of silos have been refilled from the good crops which were reaped. The importance of having a food reserve under the soil in the form of extra cassava plots is also being slowly recognized, and extra planting, particularly in the form of ten-acre village blocks, was still further stimulated by the danger of invasion by desert locusts in the near future.

The pattern of African agriculture has undergone some marked changes in recent years. The shortage of locally-produced groundnuts has already been mentioned; this was not caused so much by poor yields but rather by the fact that increasing areas are being put down to the relatively easier and more highly priced sunflower crop. High prices have also stimulated the growing of more castor seed. In the Lake Province, which produced a large exportable surplus of rice in the middle forties, two dry years have turned the native away from this crop, and although 1950 was a good year the area planted was small. In the Western Province, however, the provision of

numerous small dams has stimulated interest in the rice crop. In the Southern Province there has been a swing from simsim to sunflowers and in the Poroto Mountains more wheat is being grown for home consumption.

The tendency to swing from food crops to cash crops has to be continually watched, and sustained propaganda is necessary to prevent this swing from going too far.

The popularity of tractor ploughing schemes, aimed mainly at increased rice production, is increasing steadily, and approximately 4,500 acres were ploughed in the Eastern Province alone. The largest of these schemes situated in the Rufiji delta appeared at one time to have received a serious setback for the 1950-51 season owing to the fact that the charges had to be increased above the previously uneconomic level, but at the last moment heavy bookings for the ploughs at the higher rates were received. In the Ulanga district one chief plans to extend his rice planting to 400 acres

MARKETING AND GRADING OF PRODUCE

The Grain Storage Department was again responsible for the purchase and distribution (at controlled prices) of staple foodstuffs. Storage facilities were increased and a start was made with the introduction of drying machinery. Further trials were made with the treatment of grain against insect infestation, and treatment on a large scale was carried out in the Eastern Province. The whole of the wheat crop is handled by the Kenya Farmers' Association.

The system of local produce markets organized by Native Authorities was further extended. A small levy is made on all produce handled which goes towards the payment of staff and the erection of buildings.

The grading and marketing of sisal is organized by the industry; a smooth and efficient service has been evolved.

Higher prices under the Ministry of Food contract were obtained for the "mild" coffee crop from the Northern and Tanga Provinces and the Mbosi district of the Southern Highlands: African and estate crops were bulked together. The African crop from Rungwe was sold on the open market through the Rungwe Co-operative Society.

"Hard" coffees from Bukoba were handled by the Bukoba Native Coffee Board, part being sold on Ministry of Food contract and part on the open market in Mombasa. The crop passes through the grading sheds at Bukoba.

The Lake and Central Line cotton crops were again sold to the Raw Cotton Commission at record prices. A.R. lint at Mwanza sold at 26·75d. per lb. lint f.o.b., Shinyanga 25·75d. per lb. and Central Line 29d. per lb.

With the sale of 923,603 lb. to local firms, the last of the individual growers' contracts for Iringa flue-cured tobacco expired. The remaining 1,839,482 lb. were marketed through the sheds of the Southern Highlands Non-Native Tobacco Growers' Union, which will in future handle the whole crop. By the end of the year negotiations with a prominent and experienced firm to act as sole selling agents were well advanced.

The fire-cured tobacco crops from the Biharamulo and Songea districts were controlled by the Nyanza-Tabe Native Tobacco Board, and the Ngoni-Matengo Co-operative Union respectively. The former increased its previous production by a third. The latter sustained losses through the inadequacy of its buildings to handle a large crop, but the new premises should be ready in time for the 1951 harvest.

The tea manufacturing companies are either members of the East African Association of Tea Growers or else adhere to a control of tea distribution which that Association organizes. The Pool undertakes to supply the local market at fixed prices, which during 1950 were approximately half those obtained for that portion of the crop which was exported. Tanganyika producers were particularly hard hit by this arrangement since yields of leaf are considerably below those in Kenya or Uganda, but the quality is appreciably better than that required for the bulk of the local market. The arrangement by which the Pool paid a premium of fifty cents per lb. above the local price to Tanganyika producers as a form of subsidy came to an end in May but was prolonged till the end of October while a compromise was sought. A temporary agreement was eventually reached under which the Pool undertook to pay higher prices for Tanganyika teas, and by way of compensation the local price was raised by fifty cents per lb. in this Territory only.

The "fly" crop of oranges at Muhesa was a record, but approximately 600 tons out of a total of 1,700 tons had to be thrown away through lack of a market. Experimental consignments of selected fruit wrapped in diphenyl paper gave promise of good markets in Nairobi and Aden, but London was not interested. A London firm reported rather unfavourably on a trial shipment of juice, and the general prospects of juice marketing apart from Nairobi are not very promising; high transport charges are an adverse factor which can only be overcome by evaporation of the juice before marketing.

Buyers continued to be somewhat apathetic to high quality in copra, but a good premium was nevertheless obtained for the produce from the collective kilns at Gombero (Tanga Province). The local market was controlled at prices lower than Ministry of Food contracts which are again well below world parity. An increase from Shs. 12 75 per frasila to Shs. 14/85 was made during the year but even this was insufficient to prevent smuggling to Zanzibar, where the Ministry of Food price rules the market.

AGRICULTURAL FINANCE

The Land Bank of Tanganyika moved its headquarters from Arusha to Dar es Salaam during the course of the year. The Bank operates on a capital of £300,000 lent by Government and grants loans at an interest of five per cent to non-native farmers for the purchase of machinery and for long-term improvements to property. Short-term advances are also made.

The Kenya Farmers' Association grants short-term credits to its members, and members of the Southern Highlands Non-Native Tobacco Growers' Union can obtain crop or fertilizer loans from that body.

Native Authorities and individual Africans can obtain loans for expanding their activities from the Local Development Loan Committee which has a capital of £50,000 advanced from Development funds. Some of the joint ploughing schemes are financed in this way. During the year there was a welcome increase in the number of applications from individuals for loans for the purchase of plough oxen and ploughs, and also for the clearing of new land were granted.

PRODUCTION COMMITTEES

Production Committees set up under the Crops (Increased Production) Ordinance continued to function during the year at Moshi, Arusha, Mbulu, Kilosa, Morogoro and Iringa. The committees were originally set up during the war period to issue planting orders to farmers and thereby ensure that full use was made of the land. The system is still kept in being as a basis for assessing a guaranteed minimum return in case of crop failures. During the year a total of £10,000 was paid out on this account, mainly to farms in the Southern Highlands.

These committees also serve a very useful purpose as a forum for the expression of local farming opinion, and in this way act as a direct link between Government and the farmer. Representatives of the Department sit on all Committees, and in three cases special Executive Officers are paid from Departmental funds.

LOCUSTS

The Lake Rukwa and Malagarasi depressions are recognized outbreak areas for Red locusts: they are kept under very careful observation by the Red Locust Control Service. Some hatchings took place but no migration into cultivated areas occurred. A recrudescence of activity became apparent at the end of the year when intensive measures of destruction were put into operation.

It became clear from the movements of desert locusts in the Red Sea-Somaliland areas in the middle of the year that an invasion of Tanganyika in 1951 was almost inevitable. Steps were therefore taken to organize a scouting service and to lay in stocks for offensive action. The Desert Locust Control organization centred on Nairobi, however, assumed executive responsibility for all campaigns and scouting in November; close liaison with the District Administration and Department of Agriculture was arranged.

PESTS AND DISEASES

In the Eastern Province field mice were very destructive to cotton. Elsewhere pigs, rats and baboons took their toll of native food crops. Hippopotami and birds have also been damaging. In many districts the Africans are somewhat apathetic as regards the destruction of vermin and a great deal of persuasion is necessary before successful drives can be organized.

Cotton was damaged by American Boll Worm and stainers.

Good progress in Bagamoyo and Kisarawe in cleaning up Coconut Beetle was made.

Onion thrips were damaging in Kilosa, and pyrethrum in Southern Highlands was affected by thrips.

Stalk-borer in the Western Province and Southern Highlands continued to hamper maize production.

The spread of the white coffee borer up the slopes of Kilimanjaro continued, and is beginning to give cause for some alarm; control methods are rather tedious and are consequently liable to be overlooked by both native and non native planters. It is also doing damage in the Southern Highlands.

Cutworms caused losses to newly planted tobacco in the Iringa District, and the crop also suffered from nematodes on valley bottom soils.

The propagation of virus resistant strains of cassava continued to the full extent of the material available.

Important diseases identified during the year were Hemeleia on coffee virus mosaic on tobacco, Rusts on wheat, but there was nowhere a widespread epidemic.

The Reports of the Entomologist, Morogoro and Plant Pathologist, Lyamungu, are included in Section V of this report.

AGRICULTURAL EXPORTS, 1950

The difficult year of 1949 with subsequent food shortages is reflected in the export statistics for 1950 when exports of cash crops and raw materials in general continued to rise, but the export of food crops was very much reduced. Tea, coffee, gum, tobacco, pyrethrum and sunflower showed an increase, as did some oil seeds and onions. Groundnuts, rice, sorghum, maize and sugar decreased, as did beeswax, which is very dependent on adequate rainfall. Yields of sisal and coconuts were still affected by the 1949 drought and both show decreases in quantity though the value of the former was greater than in the previous year. The table given in Appendix II compares exports with those of previous years. The figures supplied by East Africa Customs give no account of movement from Tanganyika to Kenya.

EXPORT CROP FIGURES

The following table shows the value and total quantity of exports of the Territory for the past three years :—

		Total Amount Tons		*Value in £*
1948	...	170,451	...	12,850,137
1949	...	176,726·6	...	16,379,732
1950	...	184,467	...	20,234,097

NOTES ON MAIN CROPS

Sisal

On the Tanga Line where the acreage of 185,000 under sisal represents over fifty per cent of the total for the Territory the after effects of the drought in 1949 caused a decrease in production of some 2,500 tons of fibre. The Eastern and Southern Provinces, however, showed slight increases over the previous year.

The quantity produced by Provinces was (in tons) :—

Province	*1946*	*1947*	*1948*	*1949*	*1950*
Tanga and Northern	60,609	60,599	68,464	72,349	69,866
Eastern	36,075	33,839	38,447	39,737	40,002
Southern	10,124	11,114	13,711	11,210	11,730
Total	106,808	105,552	120,622	123,296	121,598

The following figures show the production, exports and exports value for the last five years :—

Year	*Production Tons*	*Exports Tons*	*Value £*
1946	106,808	111,521	3,916,405
1947	105,552	95,856	5,469,443
1948	120,622	117,092	8,934,461
1949	123,296	132,514	11,111,232
1950	121,598	118,909	11,846,057

The importance of sisal to the economy of the Territory can be gauged by the fact that the value of the tonnage exported represented more than half the total sum received from abroad for agricultural produce. These figures adequately illustrate the rapid growth of the industry.

In the Eastern Province many new tractors and a considerable quantity of heavy clearing and cultivation equipment made their appearance on sisal estates which previously had been run almost entirely by hand labour. There was a considerable increase in planted acreage during the year since many sisal estates have been given extensions to their existing property.

In the Lake Province, Africans have developed a cottage industry by cutting the sisal planted as boundary hedges and combing it on simple machines. The total production is estimated at 6,000 tons valued at £120 per ton to the grower.

The Sisal Experimental Station continued its investigational work. This year marked the change-over of ownership to the Tanganyika Sisal Growers' Association. The report of the Senior Research Officer is printed in full in another section of this report.

The areas affected by the sisal weevil were unfortunately extended during the year, and considerable damage was done, particularly to young plantings. The investigation of this pest and the trial of methods for its control have been entrusted to a well-known firm of specialists in this work.

Coffee

The total exports for 1950 were 14,991 tons compared with 12,040 tons in 1949, 11,259 tons in 1948 and 13,858 tons in 1947. This steady upward trend is due to greater planting, improved methods of management and planting of heavier bearing strains.

The following table shows estimates of production by districts :—

Province	Area	African Arabica	African Robusta	Estate Arabica	Total 1950	Total 1949
Northern ...	Moshi* ...	4,800	—	710*	5,510	4,046
	Arusha/ Mbulu* ...	400	—	1,190*	1,590	654
Tanga ...	Handeni ...	—	7½	—	7½	—
	Usambaras and Pares	64	—	70	134	—
Southern Highlands	Mbosi/ Rungwe ...	370	—	294	664	720
Southern ...	Songea ...	110	—	—	110	55
Eastern ...	Morogoro ...	not available separately			122	—
Lake ...	Bukoba ...	1,625	6,420	—	8,045	7,470
	Bugufi ...	220	—	—	220	—
	Total ...	7,589	6,427½	2,264	16,402	—

*Estimate

On the whole conditions have been good but a dry spell at flowering time reduced the Northern Province Arusha Mbulu crop and in all areas white stem borer was responsible for some damage. The biennial cycle of production unfavourably affected the Northern Province estate coffee.

African Produced Coffee

The Arusha crop of 400 tons was nearly double that of last year and the Moshi crop represented a small increase, 1,800 as compared with the 1,225 tons of last year.

The reports of the Moshi Native Coffee Board indicate that the present crop is of good quality with a high proportion of the AA, A, and B grades.

Extension work included teaching of coffee farmers at the Kilimanjaro Native Co-operative Union school, the organization of spraying campaigns against Antestia, and the planting of high yielding plants at propagation centres which are now under the supervision of a European Horticulturist.

The Tanganyika Coffee Curing Company, Ltd., jointly managed by the Tanganyika Coffee Growers' Association and Moshi Native Coffee Board, have made alterations to their curing works to allow of more efficient handling of the crop. The total output in 1949 50 was 6,080 tons. Extensions to the plant are in hand.

In the Usambaras there are some 1,666 native growers. A Growers' Association has been formed which hopes to be registered as a Co-operative Society. In the Pares a Growers' Association already handles the arabica crop.

In Ukerewe, Lake Province, there is a small arabica coffee industry of 1,000 growers. A small crop is also produced in Songea District.

Estate Coffee

The following table illustrates the production over the last five years (figures in tons) :—

Province	*1944 45*	*1945 46*	*1946 47*	*1947 48*	*1948 49*	*1949 50*
Northern ...	2,558	2,992	827	2,635	1,301	1,900*
Southern Highlands ...	305	60	283	194	346	294
Total ...	2,863	3,057	1,110	2,827	1,647	2,194

*Estimate

The general standard of management on Northern Province coffee estates has improved in recent years, but the control of white stem borer still leaves much to be desired. This last year has been unfortunate inasmuch that the weather at flowering time was unfavourably dry. In the Usambaras there is much room for improvement and due to present high prices much rehabilitation of plantations is taking place.

The Southern Highlands Province estates, though favoured by good weather, showed increasing evidence of a physiological disease known as "wither tip" the cause of which still remains to be discovered. Though the yields from these estates are not high the quality is exceptionally good.

Cotton

The Lake Province crop of 38,905 bales was disappointing, though an improvement on last year's production of 37,361 bales. Early in the season the crop was extremely promising and at least 50,000 bales were forecast, but prolonged rain steadily dashed these early hopes. Much damage by American Boll Worm was recorded, due in part to an abnormal amount of early planted maize.

The Eastern Province produced a very good crop that was later lost to plagues of field mice, the lethargy of the native cultivator at picking time, and extensive boll worm infestation.

The Northern Province crop, particularly in Moshi, was good. Due to the slightly higher price, larger acreages were planted.

In the Handeni District of Tanga Province wet conditions prevailed and insect damage was great, while a poor season occurred in Southern Province.

The production in lint of bales of 400 lb. was as follows :—

Province	*1940/1949 (Average)*	*1947*	*1948*	*1949*	*1950*
Lake	35,122	32,250	45,381	37,361	38,905
Eastern	9,786	6,036	7,205	12,579	8,433
Northern	1,255	403	185	398	1,356
Tanga	1,010	492	914	666	849
Southern	753	182	148	304	172
Total ...	47,926	39,963	53,823	51,308	49,715

The policy of steadily replacing local varieties in the Lake Province with the improved strains developed by the Empire Cotton Growing Corporation at Ukiriguru was carried a stage further by the distribution of 5,000 tons of U.K. 46 seed. Owing to labour difficulties at some ginneries, Shinyanga was the only district which could not be covered by this service. Two hundred tons of U.K. 48 were distributed to growers near Buchosa ginnery: this strain combines the qualities of U.K. 46 with resistance to "blackarm" disease.

A system of withholding the issue of ginning licences until after satisfactory ginnery tests had been carried out by the Ginnery Inspector in the Lake Province had good results.

Ginning standards have improved and lint of a high standard has been produced. Very little cotton was stored in the open at buying posts.

Labour in the ginneries is becoming increasingly scarce and the ginners appreciate the need for labour-saving devices.

Groundnuts

Total production surplus to planters requirements only amounted to 2,400 tons as compared with 10,900 in 1949. As a result it was necessary to import 3,000 tons into the Territory in order to fill the needs of the oil mills, and for the first time for many years there was no export from African holdings. In the main growing areas situated in the Lake, Western and Central Provinces there was a very serious reduction in the acreage planted. This may have been partly due to the heavy purchases of seed by the Overseas Food Corporation, but can also be accounted for by rosette disease and the planting of the more certain and higher priced sunflower crop. In the Southern Province however there was an increase in production.

An increase in the controlled price was announced towards the end of the year, seed supplies were organized in some districts, and every effort was made to bring back this crop to some semblance of its former pre-eminence.

The production figures quoted above and for other crops in this Report do not include the Overseas Food Corporation farms, particulars of which may be found in the reports of that organization.

Sunflower

This relatively new cash crop withstands drought comparatively well, and due to the high price obtained and ease of harvesting it is popular with natives who may incorporate it with food crops or sow single stands of the plant.

In the Western Province and Southern Province there were increased plantings with a possibility of endangering food supplies. The season in the Eastern and Central Provinces was poor, but in the Arusha district planters and Africans alike produced good crops. In Tanga Province, Africans have shown a declining acreage due probably to overselling with resultant shortage of seed.

The total production in tons for the last three years was as follows :—

1948	...	2,288 tons
1949	...	2,957 tons
1950	...	4,117 tons

Sesame

Main production of this crop is localized in the Southern Province where again a smaller acreage was planted. The season however was a good one and provincial production was slightly higher than in 1949, though still far below 1948. No premium is now offered for the white seeded variety, and the quality of the crop is very mixed.

Production (in tons) was :—

Province	*1948*	*1949*	*1950*
Lake	—	27	12
Eastern	355	238	232
Southern	3,816	1,710	1,740
Western	—	4.3	8
Total ...	4,171	2,015.3	1,992

GRAIN CROPS

Rice

The crop was a good one in Lake, Eastern and Tanga Provinces, but elsewhere the crop was poor to average. The rice dams of the Western Province were not used to full advantage, and heavy flooding at planting time reduced the Southern Highlands Province crop.

In the Luengera Valley of Tanga Province the irrigation furrow provided yields of one and a half tons paddy per acre.

Owing to poor communications in the Ulanga district of the Eastern Province there was considerable difficulty in evacuating the crop, and it is feared that an unusually large quantity was converted into beer.

The production (in tons) of paddy was :—

Province	*1947*	*1948*	*1949*	*1950*
Lake	8,250	7,660	1,293	5,155
Western	3,933	1,982	223	914
Central	60	24	3	20
Eastern	6,444	2,455	1,593	6,564
Northern	—	—	—	194
Tanga	2,086	2,017	624	1,622
Southern	3,586	1,598	1,291	2,783
Southern Highlands ...	3,372	2,475	3,670	3,228
Total ...	27,605	18,312	8,697	20,480

The controlled average price of paddy at the mill was increased from twenty-three cents per kilo to twenty-six and a half cents in June, but even so it is believed that much of the crop never reached the markets.

Wheat

Production was slightly in excess of 8,000 tons, which compares with 4,400 tons in each of the previous two seasons. The Northern Province crop was again a record with average yields in Mbulu of 8 bags per acre and at Ngare Nairobi 4.8 bags per acre, but in Arusha conditions were too wet and weeds and rust reduced the average yield to 2.6 bags per acre.

In the Southern Highlands Province 2,800 acres were planted on estates but yields were low. The price in this province to the grower was fixed at Shs. 45/- per bag of 200 lb. compared with Shs. 40/55 in the Northern Province.

In the Western Province and Southern Province, where the production is African, the area planted was small. The price of twenty cents per kilo is considered too small to encourage production on a large scale, except for home consumption.

Maize, Sorghum and Millets

In the chief maize growing areas of the Northern, Eastern and Southern Highlands Provinces and at Handeni in the Tanga Province weather conditions were favourable and excellent crops were harvested, though in the Highlands ripening was seriously delayed in some areas. In the Northern Province particularly yields were very high and surplus production amounted to 13,500 tons from non-native farms with an additional 10,400 tons from African farms: 1,000 tons from the Kilosa district was also a good achievement.

The Eastern, Lake and Central Provinces are inclined to be marginal for maize and more suited to sorghums owing to the danger of a dry spell intervening between sowing and flowering: this did in fact occur in some districts and crop failures resulted, but in others fair crops were reaped. An appreciable proportion was eaten green.

The Sorghum crop was, generally speaking, up to standard, but in the Southern Province yields were greatly reduced by a long damp spell with heavy cloud during the flowering and ripening period. 12,500 tons of sorghums and millets passed through the markets.

Stem borers reduced the grain crops in some parts, particularly in Mbulu, and army worms were very active early in the season.

In the Central Province 6,850 tons of grain were stored in Native Authority silos as the result of a levy made for this purpose. This should go a long way to mitigating the effects of local food shortages to which this province is particularly subject.

Though detailed figures are not available sisal estates are known to have produced more maize than usual for feeding their labour forces. It is estimated that 5,900 acres were planted on estates in Tanga Province and planting on the Central Line was also heavy.

The eleusine crop, a beer crop, on Kilimanjaro was poor but good in the Southern Highlands.

Due to domestic consumption it is difficult to assess production of grain crops but the market figures were as follows :—

Maize (in tons) :—

Province	Estate		African		Total	
	1949	1950	1949	1950	1949	1950
Western	—	—	848	3,433	848	3,433
Central	—	—	—	3	—	3
Eastern	1,598	12,000	590	6,885	2,188	18,885
Northern	—	13,456	—	10,345	8,223	23,810
Tanga	—	—	—	5,585		5,585
Southern	—	—	3,569	4,164	3,569	4,164
Southern Highlands ...	1,189	1,179	4,935	7,414	6,124	8,593
Total ...	2,787	26,635	9,942	37,829	20,952	64,473

Copra

The production and exports of copra in tons for the last four years are as follows :—

Province	*1947*	*1948*	*1949*	*1950*
Eastern	2,193 ...	4,764 ...	9,388 ...	5,508
Tanga	2,684 ...	2,879 ...	5,147 ...	4,557
Southern	571 ...	625 ...	1,751 ...	943
Total ...	5,448 ...	8,259 ...	16,286 ...	11,008
Exports ...	40 ...	48 ...	3,585 ...	886

Some improvement in cleaning up coconut plantations occurred as the result of constant propaganda. Plant sanitation has shown that progressive planters can nearly double their yields. Much remains to be done, however, and the production of good quality copra continues to be a big problem. In the Southern Province there is a heavy demand for consumption nuts, and the surplus for copra manufacture is not large.

In the Tanga Province nut yields were low and of poor quality on account of the 1949 drought and 152 nuts were required per frasila of copra instead of the usual 115.

Extension work included teaching and propaganda on coconut sanitation mainly in an attempt to combat coconut beetle *(Oryctes monoceros)*.

The Gombero Coconut Scheme, a joint Native Authority and Department of Agriculture project, is fully equipped to prepare first class copra on kilns of an improved type. The nuts are bought from African growers and copra is prepared in a central kiln under expert supervision, with a daily intake of 6,000 nuts during the working season. It was possible to pay a slightly higher price for nuts and still to show a profit on business for the repayment of the loan raised for this project. Thus all the sections of producers of coconut oil benefit since the quality of copra is far higher than that made by sun drying in the humid coastal atmosphere.

Tea

The total area of tea in the Usambara Hills was increased by the addition of a new estate making the total 2,167 acres, while the Southern Highlands Province acreage was recorded as 6,855 acres. Production (in pounds) was as follows :—

Province	*1946*	*1947*	*1948*	*1949*	*1950*
Tanga	339,192	341,029	323,260	452,000	473,864
Southern Highlands	1,141,727	1,028,280	1,168,149	1,001,132	1,274,808
Total ...	1,480,919	1,369,309	1,491,409	1,453,132	1,748,672

Mufindi estate in the Southern Highlands Province recorded the highest yield in its history. Areas of young tea are now coming into bearing and further new plantings were made; fertilising with sulphate of ammonia is becoming a standard practice. Good growing conditions and good estate management kept the tea in good shape and was reflected in the crop obtained. In the Tukuyu district also yields were good, and planting of new areas proceeded apace. The majority of the crop is exported to the United States of America.

Tea Seed was exported to Kenya and Uganda from Rungwe and Mufindi in the Southern Highlands Province. A hitch occurred at one stage owing to the discovery of a seed borer in some of the consignments and restrictions were imposed; but the borer was later found to exist in the importing territories also and the situation became easier.

Sugar

The only large estate in the Territory produced a record crop of 8,055 tons of refined sugar and 135 tons of brown sugar. Soil management of the saline areas of the Upper Pangani Basin (where the estate is situated) is becoming more thoroughly understood and a shorter ratooning cycle to overcome insect pests has been adopted. Fertilizer trials have also yielded results which are being put into practice. The estate has the advantage of a good irrigation supply. Production for the last three years was :—

1948—6,088 tons; 1949—7,429 tons; 1950—8,055 tons

In Bukoba, Lake Province, a pilot sugar estate was started on seventy acres of peaty soil near the Lake and a jagree plant is in process of erection for initial assessment of the potential yields.

In the Eastern Province jagree production fell from 1,289 tons to 1,020. There are in addition several small sugar farms owned by Arabs or Indians in various parts of the Territory : they extract unrefined brown sugar in very primitive presses. The estimated total production of jagree is estimated at 1,000 tons.

Most of the sugar produced in the Territory is consumed locally.

The production of flue-cured and fire-cured tobacco has expanded considerably in the past year. The following figures (in lb.) illustrate this expansion :—

	Flue-cured Iringa	*Fire-cured Songea*	*Fire-cured Nyamirembe*
1946	... 1,027,164	... 585,860	... 107,200
1947	... 749,389	... 389,740	... 179,250
1948	... 1,901,385	... 1,341,760	... 291,200
1949	... 1,710,816	... 1,989,120	... 321,942
1950	... 2,863,085	... 2,856,000	... 407,644

The Ehlers variety again provided the bulk of the Iringa crop, but one or two growers experimented on a very small scale with other types. The great merit of Ehlers is that it cures, when well managed, to an excellent colour, but it is difficult to remove the green tinge from other varieties. In addition Ehlers produces high yields, and one farmer at least obtained over 1,000 lb. of cured leaf per acre. The new steam chambers at the processing sheds of the Southern Highlands Non-Native Tobacco Growers' Union gave a certain amount of trouble owing to faulty design, and as a result some of the consignments to Europe suffered heavy claims due to heating in the centres of the bales. It is hoped to rectify the fault for the 1951 crop.

A second flue-cured tobacco area is in the process of being developed in the south-east corner of the Songea district. Forty 500-acre farms have been surveyed and twenty of these have been made available for immediate alienation. A small tobacco station has been established on one of these farms where a Tobacco Officer has started variety and fertilizer trials.

The Songea fire-cured crop was a record one. Unfortunately the old tobacco factory at Songea proved quite inadequate for handling the 1,275 tons of leaf brought in by growers. The factory losses are expected to be so high that the total output will be only 850 tons of cured leaf. A new and enlarged processing plant is being erected.

The Nyamirembe fire-cured crop, which consists of native grown tobacco from Kibondo, Ngara and Biharamulo districts in Lake Province, recorded 182 tons at an average growers price of 99 cents per kilo, an increase of 3 cents per kilo over the previous crop.

In the western Usambaras, roll tobacco is the main cash crop of the natives. The leaf, after drying, is wetted and rolled into cakes. This year 170 tons selling at Shs. 2 - per kilo was marketed, mostly at Mombasa. The growers have organized themselves into a Society and a levy of Shs. 2 - per twenty-five kilos sold is self imposed: the proceeds are being banked against future expenses when a co-operative is ultimately registered, and will be utilized for better processing and marketing.

Elsewhere roll tobacco is widely grown but on a very small scale for local consumption, though fifteen tons coil were exported from Songea.

Nicotiana rustica, used in the preparation of insecticides, was grown as a trial on many holdings at higher altitudes in the Southern Highlands but the value of the crop has not yet been assessed. Many of the growers reported poor results, and only 22,148 lb. were consigned from Iringa during the year.

Pyrethrum

Production over the last five years was as follows (in tons) :—

	1946	*1947*	*1948*	*1949*	*1950*
Northern Province	298	204	101	91	144
Southern Highlands Province ...	476	303	149	150	149
Total ...	774	507	250	241	293

The world demand for pyrethrum flowers remained far in excess of supply; this state of affairs was accentuated to a certain extent by signs of a revolt against the use of synthetic formulations in the United States of America. The discovery of a means of synthesizing one of the natural pyrethrins, though causing a stir at first, did not affect the market, and the year closed with a price of Shs. 2/52 per lb. f.o.b. for flowers containing 1·5 per cent pyrethrins.

Production increased as new plantings made when the commodity began to recover from the disastrous post-war slump, came into bearing. In the Northern Province negotiations between growers and the Forest Department to allow planting in the reserve on Mt. Meru were at last satisfactorily concluded. Since the pyrethrin content of flowers in this locality is exceptionally high this arrangement should lead to an increase in quantity of high grade material. Some replanting took place in the Southern Highlands.

The pyrethrum growers impose a cess upon production, amounting to four cents per lb. of flowers sold, for the purpose of supporting the research which is carried on in Kenya. In the Southern Highlands of Tanganyika the Department carries out fertilizer and spacing trials.

The Southern Highlands Growers' Association were granted a Government loan for the purchase of a hydraulic baling press from Kenya, and this had been installed in the Kenya Farmers' Association premises at Iringa by the end of the year.

Papain

Over the turn of the years 1949-50 there was a catastrophic fall in the price of papain which resulted in an almost complete cessation of tapping and production fell from 119 tons in 1949 to a mere five tons in 1950. Towards the end of 1950, however, the market again strengthened, but by this time the old plantings were moribund, and there were no new areas coming on to take their place. There was consequently a sudden brisk demand for seed which could not always be filled, but by the end of the year some fresh stands were becoming established. Extensive planting is not likely to take place till the long rains of 1951, but planters are inclined to be shy of this very speculative crop.

Seed Production

The progress of the industry, centred round Arusha, continued; exports of seed beans and peas were made to the United Kingdom, South Africa, Australia, France, the United States of America and Canada.

Past production (in tons) is as follows :—

1945	*1946*	*1947*	*1948*	*1949*	*1950*
540 ...	534 ...	549 ...	1,665 ...	1,655 ...	1,401

For 1950 the crop was well up to quality though some of the earlier plantings suffered from too much rain and some stands of seed peas were ruined by insect pests. Mosaic disease was recorded but the fields were rogued.

Rumours of new restrictions on the import of pea and bean seed into the United Kingdom caused considerable alarm at one stage, but a satisfactory solution was reached when the Ministry of Agriculture undertook to allow the entry of all seed, the contracts for which had been registered with them in advance.

An attempt was made by one firm of seed merchants to extend the growing of pea seed to the Southern Highlands. The time of planting of the crop proved to be a vital factor : many of the farmers who undertook experimental plantings sowed too late, and results in the main were very disappointing. Others do not appear to have realised the meticulous care and constant vigilance which are necessary to establish a sound reputation in this exacting but profitable line of farming.

Two or three growers in the Northern Province expanded their activities in the production of seed of certain flower species among which *Phlox Drummondii* and Antirrhinum were prominent. Trials were also made with other vegetables.

Amendments were made to the Ordinance in order to maintain the high standards on which the industry depends.

Onions

In the Northern Province the crop was a disappointing one, due primarily to continued wet weather resulting in bulb rot. In other provinces production increased.

Five tons of seed for resale to onion growers, was imported by the Department of Agriculture from India. Attempts to produce seed in the Territory were again made in several districts, but the yields were too low and costs of production too high to make this proposition a commercial success.

Figures of production (in tons) are :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Moshi	875	740	991	830	1,154	586
Mbulu/Arusha	1,325	943	967	1,255	1,037	734
Lake	—	—	—	—	144	148
Central	—	—	—	—	—	640
Eastern	168	153	89	119	150	263
Total	2,368	1,836	2,047	2,204	2,485	2,659

Cassava

The food shortages, continuing from the previous year of drought, have shown clearly the value of the cassava crop as a reserve against famine. The quantity of marketable cassava had fallen considerably and where cassava plantings were inadequate, famine relief was necessary.

As a measure against future crop failures and possible attacks by locusts, considerable plantings of new areas were made particularly in Central and Eastern Provinces where administrative support has been most effective. In Central Province ten-acre communal blocks were cleared and planted to a total of 2,647 acres of which 1,453 were in Manyoni District.

In Western Province the bitter variety is very popular as damage by vermin is reduced.

There was some considerable movement of cassava root to meet local food shortages.

In the Southern Province, normally a big producer of cassava, there was a serious decline in planting, due to the peasant becoming increasingly conscious of more highly-priced crops.

Sales of cassava root (in tons) were as follows :—

Province	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*
Lake	—	—	—	—	—	30
Western (root and flour)	—	—	1,035	6,442	2,380	1,751
Eastern	1,386	155	470	282	583	19
Southern	—	—	—	—	6,041	1,252
Total	1,386	155	1,505	6,724	9,004	3,052

Pulse Crops

Though production appears to be increasing, there was still a shortage of mixed beans for feeding to labour in the territory; to a certain extent this deficit is due to swing over to haricots, mainly for export, in the Northern Province.

The weather was unfavourable, being too wet in Tanga Province and severely dry in Southern Highlands Province. The Northern Province crop was good and haricot beans in Arusha reached the 2,232 ton mark. In the Southern Province production consisted mainly of cow pea. In the Bukoba district 832 tons of soya bean were produced. The production figures quoted below represent the surplus over domestic food requirements :—

Province	Total	Mixed Beans	Haricot	Chickpea	Cowpea	Gram	Pigeon Pea	Soya
Lake	7,058	1,810	—	4,403	13	—	—	832
Western	551	451	—	16	14	9	61	—
Central	89	14	—	—	60	—	15	—
Eastern	802	133	—	—	187	33	449	—
Northern	3,015	783	2,232	—	—	—	—	—
Southern	2,333	—	—	—	2,333	—	—	—
Southern Highlands	307	—	—	—	307	—	—	—
Total	14,155	3,191	2,232	4,419	2,914	42	525	832

MINOR CROPS

Cinchona

Production amounted to forty tons which was considerably below the average for the last few years.

The crop is only grown in the Usambara Mountains. Difficulty in marketing has now been overcome and exports are being resumed.

Derris Root

In spite of improved world prices no great interest was shown in the growing of this insecticide and only thirteen tons were exported.

Essential Oils

These are produced in the Usambaras, Southern Highlands Province and Northern Province. Export figures were as follows (in lb.) :—

	1948	*1949*	*1959*	*Value* £
Lemon grass oil ...	24,725	8,683	1,543	927
Geranium oil	—	550	75	136
Bitter orange oil ...	2,592	4,392	*4,500	*2,500
Others	167	101	1,559	1,247

*Production figure

There was an increased interest in the production of high priced oils in the Southern Highlands.

Spices

Tanga Province produced one and a half tons of black pepper, and five tons of chillies, which is a steady production. There was little response to the phenomenal prices which were offered for these crops. This is not surprising in the case of black pepper which needs a high rainfall for optimum growth, and in the case of chillies the market was suspected to be a freak one.

Palm Oil

The Kigoma Oil Palm Industry maintained the progress made in recent years.

Production was as follows (in tons) :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Palm Kernels ...	—	125	207	263	239	224
Pericarp oil ...	—	65	34·4	11·9	26	56·3

A tree count gave the following information :—

Trees 1-5 years old ...	67,612
Over 5 years old ...	85,620
	153,232

Progress in plant sanitation was made but more attention needs to be paid to it if maximum output is to be attained. The demand for kernels was so great that local prices rose sharply, as is shown by the following figures : –

January, 1950 ...	29 cents per kilo
August, 1950 ...	30 cents per kilo
December, 1950 ...	66 cents per kilo
January, 1951 ...	Shs. 1/20 per kilo

The ten-acre nursery at Kigoma was maintained, thereby ensuring the future supply of high quality planting material.

Tanga Province production 'Non-Native' was eighteen tons of oil and twenty-five tons kernels. The estate acreage is 300 hectares, and yields are very low by Far Eastern standards.

Tung Oil

There was no increase in the acreage of 200 and production at fourteen tons remained the same. The crop is on trial at the higher elevations in the Southern Highlands.

Cocoa

The very small quantity of two tons was produced from the estate in Tanga Province.

Cashewnuts

This coastal tree crop showed a substantial increase over 1949. Production for the last six years was as follows (in tons) :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Eastern Province ...	347	218	348	661	444	1,117
Southern Province ...	3,971	1,900	1,312	4,533	3,276	4,787
Total ...	4,318	2,118	1,660	5,194	3,720	5,904

Good prices stimulated keen competition amongst traders. Production of cashew nuts has been increasing steadily in the Southern Province in recent years.

Kapok

The dry conditions prevailing in the Tanga Province proved beneficial to flowering and an excellent crop, believed a record, was harvested.

Production in tons was :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Eastern Province ...	95	220	220	200	355	184
Tanga Province ...	—	152	62	80	60	317
Total ...	95	372	282	280	415	501

Beeswax and Honey

Export production figures are as follows (in tons) :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Beeswax	792	732	410	905	525	344
Honey	177	85	118	238	37	14

The poor rains from 1947-1949 led to one of the worst seasons for many years, since the number of bee colonies had been seriously reduced, both by drought and wasteful methods of collection.

The world demand exceeds the supply of Beeswax which resulted at the end of the year in the extraordinary price of £516 per ton f.o.b. including export tax of £25 per ton. The United States of America buys a great deal of beeswax through the London markets.

the wax made by a stingless bee of the genus *Trigona*.

Honey produced in the Territory is particularly valued by the Masai for beer making, and some export to Kenya occurs. The internal price of honey for beer making is [illegible] at a loss, especially in view of the high cost of containers.

The Beeswax Officer, whose report is appended, is initiating African staff into the methods of instruction and demonstration aimed at improved technique, and Instructors will soon be in residence in all the important production areas.

Gums (Arabic and Copal)

Production was as follows (in tons) :—

	1945	*1946*	*1947*	*1948*	*1949*	*1950*
Central Province ...	—	182	106	76	132	264
Western Province ...	390	390	244	314	273	683
Total ...	1,712	1,540	350	390	405	947

In the Northern [illegible] In the Central Province [illegible] tons were collected in the Lake Province.

Rubber

Production of Para rubber (*Hevea brasiliensis*) at Sanje Estate in the Eastern Province was [illegible] 1949, fifty tons in 1948 and [illegible] 1947. Some support at Ganz estate in Tanga Province [illegible] Many [illegible] non-Government estates [illegible]

Castor Seed

This crop is [illegible] castor seed [illegible] the encouraging native [illegible] the production is [illegible] crop is suited to many parts of the Territory.

Production (in tons) was as follows :—

Province	*1946*	*1947*	*1948*	*1949*	*1950*
Eastern	268	342	698	850	699	[illegible]
Central	160	94	806	473	338	[illegible]
Southern	—	—	—	—	—	[illegible]
Tanga	—	—	—	—	—	[illegible]
Total ...	428	436	1,504	1,323	1,037	[illegible]

Production centres are Kilosa and Kongwa [illegible] in the Southern Province, Mbulu in the Northern Province [illegible] and Handeni in Tanga Province. [illegible]

Authorities to confine the crop to the boundaries of holdings or to land which is too poor to produce grain, since it is feared that the food supply may otherwise be endangered.

Betel Nuts

The crop grown along the lower reaches of the Pangani River was up to average with a production of sixty tons. The crop is uncontrolled and in the hands of Indians and Arabs.

Sweet Potatoes

A second year of drought in 1949 still further reduced supplies of planting material and the acreage planted was not so large as usual, but the crop is a valuable one because of its quick maturity and high yield of starch food. Away from the coast it is planted in drainage areas at the end of the rains.

European Potatoes

In the Southern Highlands Province and Tanga Province blight affected the native crop, in the former case reducing production from 1,000 to 755 tons. The Southern Province crop marketing system broke down when Songea traders refused to grade their purchases. The Lindi merchants resorted to importing from Kenya and the growers there by suffered until more satisfactory arrangements were made.

In the Central Province seed was provided for the Wota Plateau but the people preferred to eat the seed rather than plant.

In general the season was unfavourable. The work of testing blight resistant varieties at Lushoto in the Usambaras received a severe setback when an apparently very satisfactory strain was transferred for further trial to a Southern Highlands farm. Here it developed rugose mosaic and the whole crop had to be destroyed.

Vegetables

Production in general increased but did not satisfy the full demand. So far as Dar es Salaam is concerned the losses due to inferior methods of transport, packing and storage are so high that under better conditions the quantity produced would probably be sufficient: consumers would then benefit by lower prices, and growers by higher. The main centre of supply is the Uluguru Mountains. Seed was provided by the Department for purchase by the African growers. In Western Province there is a gratifying change in the attitude of growers who are slowly adopting cabbage, carrots and swedes, etc., instead of only growing spinach.

In the Southern Province dry weather valley bottom plantings are steadily becoming a feature of African enterprise, but most of the produce is bought by the Overseas Food Corporation and supplies to the coastal towns still present a difficult problem.

In the Eastern Province an association of growers at Kidete has been formed for efficient marketing and transport, and also to distribute the irrigation water fairly. A cess of one cent per kilo sold is raised and the

proceeds are used to buy seed, insecticides, furrow repairs and containers. The bulk of the produce is sold to Kongwa. This co-operative venture is being carefully nursed by the Department.

The Usambara Mountains supply vegetables to Tanga which received adequate quantities except during periods of bad weather which occasionally interferes with transport in this region.

The Southern Highlands is also an important producing area, and increasing use is being made of air transport to supply Dar es Salaam. Production was greatly reduced owing to a decline in demand from Kongwa.

Fruit—Passion Fruit

The one estate in the Usambaras has shown a very large increase in yield per acre following the severe drought that caused negligible production in 1949. Yields were 15,000 lb. in 1949 and 250,000 in 1950. Clear evidence of potash deficiency was obtained by trial on this estate and applications of potash have undoubtedly helped to increase yields. Native interest in this crop is slight in spite of propaganda to popularize the planting of it for sale of fruit.

Miscellaneous Fruit

In the Tanga Province bananas are exported from Pangani to Zanzibar, mangoes, grapefruit, tangerines from Muhesa to Nairobi and Mombasa, peaches, plums, apples, strawberries from the Usambaras to Tanga.

Figures in tons are as follows :—

	1948	*1949*	*1950*
Pangani Bananas ...	973	1,735	1,698
Mixed fruit	1,379	548	543
Peaches, plums, apples, etc. ...	—	—	30

The production and marketing is mainly in the hands of small farmers and traders.

There is also a large production of fruit from small orchards in the Southern Highlands. A very large proportion of this crop goes to waste every year owing to the long distances from main consuming centres, and to the lack of a central marketing organization.

Citrus

The Muhesa orange marketing organization experienced an uneven year. The object of the scheme is to market as much of the fruit as possible mainly in East African centres of which Nairobi is the most important. The balance is converted into juice of which Nairobi is again by far the largest consumer.

The main crop was a failure owing to the 1949 drought, but at the end of the year a record fly crop of 2,300 tons was purchased according to agreement from the growers. The premises were however quite inadequate to deal with

such an unprecedented spate of fruit and over 600 tons had to be buried, thereby causing a loss on the year's working.

The price paid to growers was again Shs. 17/36 per 1,000 lb.

Trial consignments of fresh fruit wrapped in diphenyl paper were popular in Nairobi and Aden, but London was not interested and also reported somewhat unfavourably on juice samples.

A reorganization of the scheme to include the production of concentrated juice came under consideration at the end of the year.

SECTION II.—WORK OF THE DEPARTMENT OF AGRICULTURE AND PROGRESS OF FIELD EXTENSION ACTIVITIES

Finance

The following approximate expenditure was incurred during the year :—

Personal Emoluments	£151,770
Other Charges recurrent	£ 57,350
Special Expenditure	£ 28,710
Total ...	£237,830

In addition to the above various projects were financed from Colonial Development and Welfare, and Development funds. Expenditure on these items was as follows :—

Personal Emoluments	£24,190
Other Charges	£21,750
Special Expenditure	£70,350
TOTAL ...	£116,290

Revenue totalled £39,580, but in addition to this figure revenue from the Coffee Research Station amounting to £1,550 was accounted for separately.

Staff—European

The Director and Deputy Director were in residence in the Territory throughout the year.

In order to relieve the pressure at headquarters a certain amount of decentralization was made possible by the creation of four posts of Regional Assistant Director of Agriculture which became operative on 1st January.

The establishment of Senior Agricultural Officers and Agricultural Officers for 1950 was fifty-one; but only four new officers were appointed, and at the end of the year the Department was still nineteen under establishment. Two officers retired. Recruitment into this branch was again extremely slow, possibly because the new service in the United Kingdom attracted most of the available men who had been trained, but the numbers accepted for post-graduate training and eventually destined for the Territory showed a welcome improvement. Their advent will not however solve the shortage of experienced officers to fill responsible senior posts since there are few who can claim more than two tours of service.

The establishment of Senior Agricultural Assistants and Agricultural Assistants for 1950 was increased to eighty-six during the year and twenty-three new officers were appointed, some of whom were recruited for their specialized knowledge of mechanization. At the end of the year the Department was still ten under establishment, three of these vacancies being due to resignations.

There were also vacancies on the specialist side for one Entomologist, one Entomologist's Assistant, one Geneticist, one Fisheries Officer, one Chemist and a Secretary. The only appointment was one Entomologist who filled a vacancy caused by retirement.

Staff—Non-European

The recruitment of competent and reliable clerks was again very slow, and there were ten vacancies in the Executive Grade establishment at the end of the year. An undue proportion of the time of highly-trained officers had therefore to be devoted to routine matters in their offices to the detriment of their outside work.

The clerical staff consisted of :—

10	Executive Division.
45	General Division.
31	Subordinate Service.
4	Temporary grades.

The field staff comprised :—

6	African Agricultural Assistants (one vacancy).
9	Coffee Grading Assistants.
91	Recorders.
20	Artisans.
93	Instructors, Junior Service.
629	Instructors, Subordinate Service.
483	Instructors, Food Production Staff.
32	Instructors, Copra Industry.
54	Overseers.
40	Motor drivers.
6	Teachers (8 vacancies).
5	Surveyors.
94	Instructors on Probation.
44	Messengers.

The increase in Instructor posts over 1949 was largely made up by the influx of forty-two trainees from the Ukiriguru School in August. The backbone of the Agricultural staff is still largely made up of the unschooled but experienced older Instructors who have personality and local prestige, but some of the men trained in recent years are already beginning to make their mark.

Eastern and Central Provinces

The Regional Assistant Director of Agriculture, Morogoro, was in charge of the Eastern and Central Provinces aided by a Provincial Agricultural Officer in Dodoma to whom the staff of the Central Province were responsible.

The bright features of the year in the Eastern Province were the bumper maize crop, the very large paddy crop in the Rufiji, the record castor crop in the Kilosa District, the sound start made in the Uluguru Land Usage Scheme and the increasing interest taken by natives in the mechanical cultivation units operating in every district of the Province.

In the Central Province good crops allowed a communal grain levy and the bulk is held in proper storage. Good progress was recorded in contour banking.

Alienation of land for Asians took place in the Magole area of Kilosa when 15,000 acres were divided into thirty farms for food production and cotton growing.

Irrigation and water supplies were increased to the benefit of rice and vegetable growers, and to cattle owners in the Central Province.

Western Province

The harvest, in general, was poor owing to a long dry spell in the growing season, and apart from a small production of palm oil the Province made little contribution to the Territory's food supply; indeed food relief to the extent of £20,000 was required in Nzega and £12,000 in Mpanda.

Groundnuts, in the past a traditional crop of the Wanyamwezi, continued their decline of recent years, but were to a certain extent replaced by sunflowers.

With vast intervening areas of bush it proved difficult to protect crops from vermin and bitter cassava was more widely planted in an attempt to combat the depredations of pig and baboon.

Development work included the increase of the fire-cured tobacco industry at Kibondo (under the Nyamirembe Native Tobacco Board), the reclamation of the Luichi delta, the resuscitation of the Kigoma oil palms, and construction of dams for rice growing.

Campaigns for cultivation involving tie-ridging were made, with varying success.

Vegetable and onion growers were encouraged and are slowly increasing in numbers.

Lake Province

Over the last few years there has been a notable improvement in the standard of living of the people, but this has not been accompanied by any large increase in the areas under cultivation. In fact the production of rice

and groundnuts has shown a serious decline not compensated by the extended cultivation of cinchona and soya beans. The coffee acreage has remained stationary, but larger numbers of seedlings are now being distributed.

A very good season was experienced, compensating for the previous bad season, which was one of the worst in the experience of the Wasukuma. A record grain crop was harvested, with the result that the food position is very satisfactory, though droughts in Bukoba gave anxiety as to the food position there.

The cotton season was disappointing since insect damage, particularly American bollworm, reduced the yield.

There is a great increase in native cash income from sale of crops and it is intended to supplement hand-hoe cultivation with tractors and ox-drawn implements, thereby capitalizing the agricultural systems for future development.

The efforts of Government in developing the land are now set in a framework of teams for consultation and co-operation, and a vast amount of factual information has been collected, with the result that planning is now possible on sound lines.

Southern Highlands

Weather conditions were good for crop growth on native lands, and production of food crops, with the exception of peas and beans, was very satisfactory, enabling export to other parts of the territory; early in the year however food imports were required until the new crops could be harvested.

Problems of grain storage have been investigated and recommendations made for the construction of stores in the marginal rainfall areas.

Most satisfactory progress was achieved in controlling the wanton burning of grass and deforestation for eleusine cultivation.

On estates, tea, coffee, pyrethrum and tobacco enjoyed a good season, though labour shortages occurred. As a result of this, capital has been invested on an appreciable scale in mechanical equipment. Maize and wheat did not do so well, and vegetable production was lower.

A very successful Natural Resources Show was held at Mbeya in September. The show, opened by His Excellency the Governor, was very well attended and great interest was taken by the general public, but the competitive classes could have been better patronized.

Northern Province

In the Northern Province a really good year is recorded, though food imports were necessary at the beginning. The wheat and maize crops were records and the native coffee crop was higher than last year, though the non-native crop was poor. In the drier areas of Arusha there were some crop failures and bananas, as a native staple food, were in short supply. The onion crop was very poor owing to excessive rain, but the Moshi cotton crop was the largest for some years.

Tanga Province

Weather conditions for the main cereal crops on the plains were good but were rather too wet for pulses. The Handeni maize crop was a welcome relief after two years of failure, and returns on those sisal estates which planted fully merited the efforts made. There was an extension of sorghum planting on coastal lands which are marginal for maize, but the best variety has yet to be found. It was unfortunate that rice land in the Luengera valley lay idle through lack of enterprise on the part of planters from the hills.

Besides being the province with the largest acreage under sisal, Tanga can also boast of the greatest variety of minor crops, grown both in the Usambaras and in the foothills. High prices stimulated the rehabilitation of derelict coffee plantations in the Usambaras, where there was also considerable activity in tea planting.

The kapok crop was a record, miscellaneous fruit and vegetables were up to recent averages, but copra production was low on account of the 1949 drought. In addition to these crops small quantities of derris, cinchona, Ceara rubber, cocoa, pepper, chillies, papain and palm oil were produced.

Southern Province

This was a disappointing year from the point of view of self-sufficiency within the Province. Some local shortages were due to erratic incidence of rainfall and floods on the Ruvuma. It is estimated that some 2,000 tons of grain will need to be imported before the 1951 harvest.

A Southern Province development plan, aiming at increased production, development of the poor communications and alienation of suitable land for tobacco, sisal and fish production has been formulated.

Songea tobacco again reached a record but factory losses will be high.

AGRICULTURAL STATIONS AND EXPERIMENTAL WORK

Coffee Research Station, Lyamungu

With favourable weather conditions the crop ripened quickly and a large percentage had been picked by early November. The rains in February and March resulted in good vegetative growth and during April and May rainfall totalled forty-one inches. The rains in November and December were insufficient to bring out all the flower buds for the 1951 crop.

All existing experiments were maintained, but due to land shortage no additional experiments were planted.

A summary of the experimental results is given below. Reference to the full report of the Senior Research Officer, which is published separately, should be made for detailed information.

A mulch of banana trash up to forty lb. per tree and irrigation sufficient to supplement rainfall up to two inches per month both produced significant increases in yield. The treatments when combined gave a still further increase.

No significant effects were obtained by treating plants during their first few years with sulphate of ammonia or with compost, nor has it been possible over twelve years to prove the superiority of any one method of cultivating old bushes.

The multiple-stem method of pruning once again gave larger yields than the single-stem system.

The relative merits of clonal cuttings and seedlings from selected mother trees are still in doubt since results over eight years are somewhat conflicting, but it would appear that the extra trouble and expense of raising cuttings may not be justified in large-scale plantings.

Two thousand, five hundred and forty-two lb. of seed from high-yielding selections were sold to growers and a total of 3,394 clonal plants were supplied to the Moshi Native Coffee Board for use as mother trees for further vegetative propagation.

The Zebu herd was further selected and all cows yielding less than 200 gallons per lactation were culled. The total milk yield for the year was 6,075 gallons, the highest yield in one lactation of 295 days was 363 gallons given by Kaya in her eighth lactation. The Sahiwal-Boran bull is effecting considerable improvement in the herd.

Maize and beans were planted on the newly-cleared areas of Lyamungu Coffee Estate as cleaning crops prior to the establishment of coffee. The maize was ensiled and will be fed to stock in 1951.

Mbosi Coffee Sub-Station, Southern Highlands Province

The station experiments are as yet in their infancy and were greatly set back by fire last year. The three main trials involve spacing, variety and establishment methods (including the use of fertilizers and compost). Shade trees (*Albizzia* spp., *Millettia* sp., and *Cordia* spp.) were planted together with a banana windbreak.

Deciduous fruit trees, Kudzu and Lespedeza, have been planted for observation purposes.

A house was built on the station.

Sisal Experimental Station, Mlingano, Ngomeni

The Research Station was brought under full control of the Tanganyika Sisal Growers' Association, by whom it is owned and financed. The Department of Agriculture continues to second staff, but the policy of the station is directed by a Research and Management Committee of the Sisal Board.

The European staff consisted of a Senior Research Officer, a Plant Physiologist and two Agricultural Assistants.

Five houses, three laboratories and an office block were erected: gas, water and electricity supplies were installed, scientific equipment was obtained and the library was enlarged.

The 1950 rainfall of 43·5″ was favourably distributed and all new experiments became well established. There are now twenty-eight experiments, mainly concerned with cultivation, spacing, cutting and manuring of sisal, besides hybrid selection tests and trials of interplanting food crops in young stands. Attention is also being given to methods of maintaining soil fertility by using grass leys and other resting crops.

It has been demonstrated that there are no deleterious effects from weed competition when young sisal is planted in widely-spaced double rows and the weed growth is confined to bands between the rows of weeded sisal.

The time of first cutting is an important factor affecting fibre yields. While sisal may be seriously stunted for the rest of its life if cut too drastically and too early, a delayed and lenient cutting is conducive to long, heavy leaves with low fibre and early poling.

Observational notes indicate that the sisal tends to be tallest and has the best colour on plots treated with calcium and phosphate, but nitrogen alone and potash have had an adverse effect by accentuating the degree of chlorotic mottling in the leaves.

In a trial started in 1947, plots receiving a total of 600 lb. per hectare sulphate of potash to overcome "banding disease", gave an increase of 1·36 tons fibre per hectare over controls. At present prices this treatment would be economic on potash-deficient soils. Leaf tissue analysis confirmed that plants showing banding disease symptoms are low in potash.

Sisal waste led to a general improvement in growth when applied as a mulch to bulbil nurseries.

Manured and unmanured food crops sown between sisal rows did not compete severely with young sisal this year, probably owing to the adequate rainfall. Plots interplanted with sorghum are most backward.

The station propagated 12,000 budded citrus trees and supplied 6,189 trees to sisal estates and others. The station maintains a small herd of Zebu cattle which are stall fed in fly-proof byres.

Ukiriguru Experiment Station and Lubaga Sub-Station

The Chief Scientific Officer and the Senior Scientific Officer, Empire Cotton Growing Corporation, the Botanist, Department of Agriculture, and an Agricultural Assistant were stationed at Ukiriguru. Lubaga, used for sub-station work, was in the charge of an Agricultural Assistant.

An extensive building programme, comprising staff houses, a laboratory and a ginnery, was nearly complete by the end of the year, but the electrical installation was held up through slow delivery of materials. The water supply was inadequate, but improvements were put in hand.

Though the rainy season was a short one, distribution was almost ideal and good yields were obtained from the grain crops.

The work of the Empire Cotton Growing Corporation scientific staff at Ukiriguru included breeding and seed multiplication, resting crop trials, using different grasses as fallow crops manurial and cultivation experiments particularly on the upland slopes. The full report is published by the Empire Cotton Growing Corporation, but the following results are of interest.

The Station experienced an unusually heavy attack of American bollworm, built up on early-planted native maize crops, and serious losses were sustained. Bacterial blight was much in evidence on susceptible material. The severe jassid attack allowed further assessment of resistance.

UK.46 showed up as a worth-while issue, with much superior jassid resistance than MZ.561; and UK.48 was superior again to UK.46. Very satisfactory yield trial figures were obtained. A UK.51, constituted from high yielding strains, is mooted.

A remarkable feature of the year's work was the significant residual effect of dressings of dung, and in some cases phosphate, in the sixth year after application both on plots comprising resting treatments and those under a continuous rotation of crops. A satisfactory explanation of the lasting effects of dung has not yet been found since all visible signs of the material had disappeared some years ago.

Cotton yields in the first season of dunging at three tons per acre were doubled on some plots; equivalent results were obtained with a comparable dressing of mineral nitrogen and phosphate. Sulphate of ammonia applied before flowering or poor land gave a profitable return.

Owing to a favourable distribution of rainfall the advantages of tie-ridging, apart from their soil conservation value, were not very apparent in the yield figures. Several trials were conducted both at Ukiriguru and Lubaga.

The Botanist undertook trials with varieties of Pennisetum millet, soya beans, sunflowers and various legumes, but his chief work was on sorghum. Selection and breeding work in this crop aims to obtain an early maturing type, yielding and storing well, with a palatable grain. Resistance to stalk borer and *Striga* are also being looked for. A collection of sorghum types has been made. Manurial, cultivation, weeding, time of planting and seed soaking trials were also undertaken, from which the importance of a very early weeding was again demonstrated.

Observation plots of mosaic-resistant varieties of cassava were laid down, and methods of controlling cassava scale were studied.

Mwabagole Rice Station

This station is situated a few miles from Ukiriguru and is also under the charge of the Botanist.

One hundred and thirty-two rice selections from other parts of the country were studied. The trials unfortunately carried on into the dry season and the crop had a large proportion of empty ears. Seed from ten of the most promising was distributed for trial elsewhere in the 1950/51 season.

The interval between puddling-in green material and transplanting had no effect on the final grain yield, although transplanting immediately following puddling-in depresses growth in the early stages. No residual effects were obtained from previous treatments.

Methods of planting and spacing trials showed that clump planting had no effect. Six inch by six inch planting was superior.

The yield of Gamti, a rice of high quality and early maturity, was higher than Kahogo, the local favourite.

Cotton Experiment Station, Ilonga

A Senior Scientific Officer of the Empire Cotton Growing Corporation is in charge of the station assisted by one of the Corporation's Entomologists and two Agricultural Assistants. Though the total area is 2,000 acres, development is by no means complete and only 214 acres have so far been cleared for planting. The main purpose of the station is the selection and breeding of improved cotton strains for the Eastern Province, but the control of insect pests, in particular American bollworm, also provides a main subject for investigation. Maize is grown in rotation with the cotton, and a start has been made with rice.

The season was rather too wet to be ideal for cotton, and insect pests were more in evidence than usual. Further progress was made in the selection work and it is hoped that the first improved strain will have reached the small scale bulking stage by 1952. Insecticide investigations were hampered by very delayed delivery of materials, but sufficient experience has now been gained to justify large-scale trials with tractor-drawn machines in 1951. The best formulation is still in doubt since DDT, whilst being effective against bollworm, encourages aphids by destroying their predators.

The labour situation remained acute and resulted in poor progress on the building programme. Two European houses and a block of labour lines were however completed.

Tumbi and Mwanhala Agricutural Stations

Tumbi

Rains were poor and harvests were negligible, causing the experimental results to be valueless.

Livestock, comprising twenty-two cattle (for training as ploughing oxen) and thirty-eight goats, were kept on the farm for the first time in five years, due mainly to bush clearing round the farm reducing tsetse fly.

Labour was difficult to obtain, but cultivation work by ox-plough and tractor was started. Capital work included the extension of the dam wall across the valley and the completion of the labour lines.

The farm was supervised from Tabora since the Pasture Research Officer of the Veterinary Department occupied the house. He was given a free run of the station facilities while opening up his own station on adjoining land.

Mwanhala

Much building activity marks the progress of the year. Two blocks of labour lines, a garage and stores were built. The stock farm buildings were completed. Two dams were improved and heightened. Farm stock included twenty-four work oxen, two bulls, twenty-eight cows, ten bullocks, seven heifers, two boars and three breeding sows. As at Tumbi prolonged dry weather during the growing season caused crop yields to be negligible and the experimental data do not justify any conclusions being drawn.

Mahiwa Experiment Station, Southern Province

Labour difficulties were also experienced at a critical stage on this station, with the result that much of the rice transplanting was delayed and weeding was always behind-hand. The crop was not therefore one of the best. Valuable seed for distribution was nevertheless obtained and the experimental results combined with those of previous years have now made it possible to discard a few varieties, including those of Hungarian origin, from the trials.

The health of the herd continued to prove that under good management there is little to be feared from tsetse fly in this area. Exceptionally good milk records running up to 480 gallons per lactation were obtained from some of the Boran cows, and the herd will shortly provide a nucleus for the distribution of fine breeding stock. Pastures were extended by further clearing, and fences were erected.

A feeding trial with goats, designed to test the effect of castration and concentrates on growth rate, gave negative results.

The growing of irrigated vegetables during the dry weather was an important feature of the station.

The Agricultural Officer, Lindi, supervised the experimental work, and a resident Agricultural Assistant was in charge of the station.

Morogoro Farm

This farm is used to demonstrate a rotation in which a three-year ley under Panicum maximum is alternated with three years cropping to grains and legumes. No experiments are undertaken, but good strains of maize, sorghum and cowpea are grown for seed distribution. The season was favourable and crops well up to average were reaped.

The dairy herd, comprising forty-five cows of mixed breeds, produced 27,360 pints of milk, of which over 12,000 were fed to calves. Drastic culling and the purchase of new stock are being undertaken to improve on these poor results.

A Ferguson tractor and implements, purchased during the year, will to a large extent replace the trek oxen previously used for cultivation, and will enable a more timely preparation of the land to be made.

The nurseries attached to the farm produced 5,078 budded citrus trees, 2,281 grafted mangoes and 6,722 ornamentals for sale.

The Indian Agricultural School is situated here; it opened in November, and began to take over the management of the farm.

Igombiro Tobacco Farm

This small farm is situated a few miles out of Iringa on the Kilosa Road; its main purpose is for the conducting of tobacco trials.

During the year both manurial and variety trials were laid down. There was an indication that the quality of leaf was improved by phosphatic fertilizers. The average yield of leaf was in the region of 1,000 lb. per acre, which is considerably above the district average.

Wheat Experiments—Southern Highlands

Two series of wheat trials were planted on private land, one at Dabaga and the other at Sao Hill. In the fertilizer trials large responses were obtained by dressings of farmyard manure and at Sao Hill both soda and super phosphate gave equally large responses. It is thought that an improvement in the technique of fertilizer placement will give more definite results in the coming season.

Variety trials were also planted covering twenty-one strains in all. No one strain proved outstanding, but a number showed considerable promise.

Pyrethrum Experiments—Southern Highlands

Four fertilizer and spacing trials were planted at Uwemba. A significant response to superphosphate amounting to approximately 150 lb. of flowers per acre was obtained and the yields from close spaced plots were significantly greater than those from the wider spacings.

Linseed Trials—Southern Highlands

The Punjab variety has now proved itself to be the most suitable for general cultivation in this Province and gave an overall average yield of oil at 330 lb. per acre, with a maximum of 560 lb. in one district. This variety is now being multiplied for distribution.

Kingolwira Prison Dairy Farm

The farm was under the direction of the Department of Agriculture with a Senior Livestock Officer seconded in charge and an Agricultural Assistant managing the arable side. The year saw a most successful start to an ambitious venture—ambitious in that the soil, the somewhat doubtful rainfall and the presence of tsetse fly all combine to make mixed farming a difficult proposition.

The object of the farm is to provide 500 gallons of milk daily for the Dar es Salaam market and at the same time to produce all the staple food and vegetables required by the inmates.

The herd was steadily built up during the early part of the year, mainly by purchases from Kenya, and the first consignment of milk was despatched by rail in thermo cans on 7th May. From then till the end of the year some 27,700 gallons of milk were produced at a running cost of Shs. 2·32 per gallon, excluding management, transport and depreciation charges. The incidence of trypanosomiasis was rather heavier than anticipated and considerable extensions to the clearings will therefore have to be undertaken.

Excellent crops of maize and sorghum were obtained. Cultivation was done mechanically, but sowing, weeding and harvesting were largely carried out by prison labour. One field of sorghum was drilled and yielded over nine bags of grain per acre.

Kungili Farm, Lushoto

The most important work on this farm consists of the testing and multiplication of potato strains which are resistant to *Phytophthora infestans*. Potatoes form a large portion of the staple food in the Usambara Hills, but since the blight descended upon the area in 1945 food shortages have been acute.

Importations of disease-resistant types have been taking place at regular intervals but the work is continually frustrated by the frequent appearance of new strains of blight. It is now hoped that three out of the fifteen varieties under trial during the year will prove satisfactory and multiplication for distribution has started. In the meantime breeding of new varieties for further trials continues at Corstorphine in Scotland.

New plants, including Sweet Yellow Lupin, *Pennisetum salifax*, oyster nut, fruit stocks of plum and apple and passion fruit, were introduced for observation purposes; the Sweet Potato variety plots were maintained.

Boza Coconut Plot—Tanga Province

This plot, situated near Pangani, is planted to progeny rows from selected and recorded mother palms in the Tanga coastal strip. A few gaps were filled, and some of the earliest plantings in favourable situations reached the bearing stage.

Soil Conservation

The soil Conservation Service, centred at Tengeru in the Northern Province, gained remarkable momentum during the year. New staff were recruited or seconded and eventually comprised one Senior Agricultural Officer in charge, one Agricultural Officer, two Soil Conservation Officers, three Agricultural Assistants and one Mechanic: this was one Agricultural Officer below establishment.

At Tengeru itself good progress was made with the building programme, trials and costings of different bench-terracing intervals were made in comparison with other methods, irrigation practices were investigated, observation plots of grasses and legumes were established and instruction courses for both European and African staff were held. Under the conditions prevailing on the station a 3-foot vertical interval giving a 12-foot bench was found to be the most satisfactory arrangement both for crop yield and for economy in construction. *Pennisetum salifax* is a promising introduction for grassing down diversion ditches and waterways, but is too vigorous for bench faces. The Senior Agricultural Officer's report is quoted in full elsewhere and gives further details.

Activities in the field were divided into two parts, first advisory and reconnaissance work on African and non-native lands, and second, the construction of soil conservation works with heavy machinery. On non-native farms in the Northern Province treatments covering 13,000 acres were planned, but it is estimated that in this province alone assistance would be required over at least double this acreage if the staff and machinery were available, and there is a big leeway of requests outstanding. In fact the response from this section of the community to the facilities provided has become almost an embarrassment.

During the first part of the year only two mechanical units were working: they were mainly utilised for perfecting technique and in training operators. Later the number was increased to ten, and work started in earnest when the crops came off the land in August. By the end of December broad-based terraces had been built on some 4,400 acres, 47,000 ft. of diversion ditches and waterways had been constructed and 60,000 ft. of farm roads realigned. The planning and supervision of such works is free, but standard charges are made to cover running costs and depreciation.

On native lands, propaganda, planning and execution of works are providing difficult problems. Not only is the African very conservative and hard to convince, but there is also the question of cattle to be answered. In almost all the native areas where conservation measures are a vital necessity the chief cause of erosion is overstocking and over-grazing on hill pastures. Until stock numbers can be reduced or alternative grazing grounds found, it is useless to attempt gully stopping and terracing construction: earth works are all too easily trampled down, and no normal diversion channels can take the run-offs from heavy storms. The first lesson to be learned is that of optimum land usage; conservation of the soil is merely an adjunct to it.

In the Central and Southern Highlands Provinces most particularly, but also in others, many miles of narrow-based contour banks were constructed by tribal turnouts under the guidance of officers of the Department. In the Lake Province attention was focused more on tied ridges, the use of which was considerably extended.

In both the Usambara and Uluguru ranges long term plans were formulated and put into operation with the object of checking erosion and introducing

better methods of land usage. Both are interdepartmental team projects to which Agricultural Assistants have been seconded to assist in the field work.

Mechanization Trials

Mechanized cultivation trials of rice using Native Authority tractors were undertaken by the Department in the Ruhuji and Kisoro Valleys and of dwarf sorghum on the Wami Plain. In the Ruhuji Valley 200 acres of land at Kitundu was ploughed, disc-harrowed and drilled with paddy at varying rates per acre. Unfortunately, the major portion of the crop was destroyed by floods or was over-run by hippopotami. The balance of the crop was harvested with a Massey-Harris No. 26 combine harvester obtained on loan from the Overseas Food Corporation. The machine worked well but considerable difficulty was encountered owing to the quantity of green material which was harvested along with the paddy. Valuable information was obtained in relation to suitable and unsuitable varieties of paddy for mechanization.

At Lupiro in Ulanga District sixty-five acres of flood plain land were cleared and planted with paddy at the rate of sixty lb. of seed paddy per acre using a normal grain drill. The seed-bed had been thoroughly prepared and very little competition from weeds was encountered. The worst weed was Buffalo bean (*Mucuna pruriens*). The yield per acre averaged 890 kilos (= ¾-ton) of paddy, but since some of the varieties grown had drooping heads it is estimated that at least ten per cent of the crop fell in front of the cutter bar. The variety "Kahogo" promises to be suitable for combine harvesting, particularly if further selection work is carried out on it. Two new strains of this variety selected by the Botanist, Ukiriguru, are being tested during the coming year. This trial has been extended to cover 200 acres during 1951.

Trials of dwarf sorghums at Wami yielded poor results owing to the excessive water-logging that occurred in this area and further experimental work is needed before large-scale trials are warranted.

Mechanization Schemes

Pilot ploughing schemes, mainly designed to extend the area under rice and financed by Native Authorities or by the Development Loan Fund, were in some cases in their second year of trial. By the use of tractors and ploughs, followed by disc harrowing the chief factor limiting the area cultivated per family is eliminated; in addition more timely cultivation is possible and there is less danger of missing the season by late planting. A fixed charge to cover running costs and depreciation is made, and funds are being built up both to repay the loans and also to purchase new machinery when replacement becomes necessary. In this preliminary stage supervision is provided by Agricultural Assistants seconded to each scheme but not charged to it. The schemes are becoming increasingly popular and there is a continuous demand for more.

As previously mentioned the largest scheme is situated in the Rufiji delta. From experience gained here it would appear that a medium-powered track tractor is the most satisfactory; with these machines hardly an hour's ploughing time was lost through breakdowns, but half-track tractors gave endless trouble. From a psychological point of view it was amply demonstrated that charges must be fixed high at the outset of a scheme since it is much easier to reduce them in the following season than to increase them. The existing units have a ploughing potential of about 4,000 acres if work starts early enough, but this figure has not yet been attained; it is nevertheless planned to increase the potential for the 1951-52 season.

In the Kilombero valley at Ulanga two-wheeled tractors on rubber tyres were kept hard at work in the 1949-50 season and excellent crops were obtained off the ploughed land. Work for the following season was curtailed through delay in obtaining spare parts: it was most unfortunate that the same part broke in both machines.

A new scheme was started in the Rovuma valley for the 1950-51 crop. The two tractors were late in arriving, and ploughing could not be started until the end of September. Nevertheless two blocks each of approximately 300 acres were ploughed. Delays were caused by incomplete hand stumping of the land.

Smaller single tractor schemes are in existence at Bagamoyo, Kilosa and Korogwe. At the latter, trials are being made with a variety of food crops with a view to tempting the inhabitants off the rapidly eroding Usambara hills down to the plains.

In the Lake Province preliminary trials were made in varying soil conditions under the ægis of the Cotton Committee. A popular innovation was the hiring of a light tractor and trailer for the purpose of carting dung on to the fields.

Inland Fisheries

It is becoming increasingly evident that the protein deficient diet of most African tribes can be substantially improved by the production of fish in greater quantities.

At Korogwe the Fisheries Officer continued and greatly expanded his investigation into methods of fish farming in specially constructed ponds. Most of his work was done with *Tilapia nilotica* which is indigenous in the waters of the Pangani River, but by the end of the year five other Tilapia species had become established in the breeding ponds. In this somewhat alkaline water which is particularly favourable for the growth of the micro-organisms on which the fish feed, it is found that a pond is ready to harvest at three months from the introduction of fingerlings. It is thus possible to obtain four crops of fish per annum from a single pond.

In an experiment to combine fish farming with rice growing in the same water, one ton of paddy per acre was obtained in the off season, but the yield of fish was only ninety-two lb. per acre. By using a paddy strain with

a longer maturation period and by different methods of management it is confidently expected that the fish yield will be improved.

The Fisheries Officer also trained African staff and gave advice on fish farming in various parts of the Territory. Particularly successful ponds were established at Moshi prison.

The second Fisheries Officer was stationed at Kigoma on Lake Tanganyika. He made a detailed investigation of the "dagaa" industry in all its aspects and also made reports on Lake Rukwa, Lake Ikimba and the Malagarasi swamp. As a result of these investigations improvements in fishing methods, fish preservation and marketing are being planned. In order to implement the plans a Fisheries Ordinance was introduced at the end of the year.

The hull of a motor vessel for investigational work in the deeper waters of Lake Tanganyika arrived at the end of the year but her engine was delayed.

Beeswax

Although found to be overproduced throughout the world, beeswax was in very short supply and prices rose to undreamed-of heights: the maximum quotation was £540 per ton. This unfortunately coincided with a year of low production owing to the fact that large numbers of bee colonies had perished during the 1960 drought. The Territory nevertheless maintained its position as one of the leading suppliers on the world market.

The Beeswax Officer, who might perhaps be more appropriately termed "Apiculturist", was stationed at Tabora, but made tours throughout the wax producing areas of the Territory. He carried out an interesting investigation into the current practice of adulterating beeswax with the very low quality product obtained from nests of a stingless bee belonging to the genus *Trigona*. He instituted proposals not only against this malpractice, but also against the destruction of colonies when harvesting and the use of inferior or dirty utensils when rendering down the wax.

He established an experimental apiary in "unioumbo" country near Tabora and managed to persuade colonies of wild bees to stay in his Langstroth hives. This apiary provided the basis on which native instructors could be trained before posting them to outside centres, and by the end of the year a training programme was in full swing.

World Agricultural Census

Tanganyika co-operated to the full extent of its available resources in the World Agricultural Census organized by the F.A.O. branch of the United Nations. An Administrative Officer was seconded to the Department to supervise the work which was carried out in the field by staff of the Agricultural, Veterinary and Forest Departments. In a territory of such a vast size it was clearly impossible to make a detailed census, but two districts in each province were selected for the survey in such a way that all the important ecological areas were covered. This decision admittedly eliminated one element of randomization, but from that stage onwards both the village units and the individual holdings were chosen by lot.

Having decided upon the individual, particulars of his family and circumstances were taken, the areas of different crops cultivated by him were measured, and subsequently yield plots were harvested and weighed. Details of non-native farms were obtained by circulating a questionnaire.

The work in native areas was carried out by African Instructors with little or no previous experience of what was required of them; added to this they frequently had to contend with a non-co-operative attitude on the part of the population. Taking these factors into consideration it is remarkable that the progress of the census was so smooth. By the end of the year all the results had been forwarded to the East African Statistical Department for analysis. A cursory glance at some of the figures obtained indicates that interesting and valuable information has been obtained, but comment is reserved until the full analysis has been completed.

Agricultural Education

Ukiriguru Training School

A plaque to commemorate the opening of the new buildings was unveiled by the Member for Agriculture and Natural Resources on 3rd March. In order to complete the programme certain minor works, including the erection of an extra dormitory for Education Department teachers, were subsequently carried out.

The numbers attending the two-year course were as follows:—

Course No. IX 42 Agricultural Instructors—3 Teachers. Completed in July.
,, No. X 54 Agricultural Instructors—9 Teachers. In progress.
,, No. XI 53 Agricultural Instructors—14 Teachers. Started in October.

The average school standard of recruits into the Instructor service is still lower than is desirable. Very few Territorial Standard X boys consider it worth their while to join at the current rates of pay, and even Standard VIII can usually find more profitable employment. It is hoped that this state of affairs will be changed shortly.

A larger element of practical work was introduced into the syllabus including a model school garden, and the Education Officer confidently expects that Course X will comprise the most satisfactory body of Instructors who have so far left the School.

Indian Agricultural School, Morogoro

Though the buildings for this school have been in existence for some years, the lack of a suitable headmaster had hitherto prevented its opening. An experienced member of the Indian Agricultural Service arrived in April to take up the appointment, and the services of two Assistant Masters were also obtained. Preliminary organization and recruitment occupied several months and the first batch of students (ten from Kenya, twenty from Tanganyika) did not come into residence until early November. From the very start the

students showed a zest for their work, and the prospects are promising. The course is to last for eighteen months, including holidays, and is designed to train farmers with a sound practical knowledge of both crop and animal husbandry..

Unfortunately the Headmaster, through sickness and other causes, resigned at the end of the year. His place was taken by a European Officer who arrived in the Territory at a most opportune moment.

Tengeru Natural Resources School

During the year plans were made to set up a Natural Resources School on the site of the Polish Refugee camp near Arusha: this site already accommodates the Soil Conservation Service and the Game Department. The objective is to train the Junior Service personnel of the Natural Resources Departments, together with selected [illegible] of the Education Department, in one institution so that while specialising in his own subject each may acquire the rudiments of the others, and so go out into the field with a broad outlook embracing all the factors which are involved in optimum land usage.

Councils, Boards and Committees

The Director of Agriculture is a member of the Legislative Council and is Chairman of the Cotton Board, Coffee Board, and the Coffee Research Station Board of Management. He is also a Member of the Sisal Board, the Tea Board, the Labour Board, the Seeds Board, the Natural Resources Board, the Southern Highlands Non-Native Tobacco Board and Tobacco Growers' Union, and the Sisal Research Station Management Committee. He is also a member of two inter-territorial bodies, the East African Advisory Council on Agriculture, Animal Industry and Forestry and the Central Tea Committee. He attends all meetings of the Pyrethrum and Livestock Boards and is Executive Officer of the Natural Resources Board.

The provincial officers represented this Department on local committees concerning the growing of crops, land utilization, District teams, Water Boards, Production Committees, etc.

Legislation

The following legislation in connection with agriculture was enacted during the year.

Export Seeds Ordinance.—Amendment Rules, 1950, requires the registration of types of seeds grown with sub-committees and [illegible] of election and representation on the Seeds Board.

Plant Protection (Import) Order, 1950, defines the conditions under which plants may be imported into the country.

Fisheries Ordinance, 1950, prohibits the import of exotic species except by permit, the use of explosives in fishing and the pollution or disturbance of waters. It also provides for the creation of Fisheries Boards in "controlled areas" with powers to declare close seasons, to regulate methods of fishing, to issue licences and to regulate processing and marketing.

The Native Tobacco (Songea Board) (Levy) Order, 1950, allows for a levy to be made on tobacco sales in order to finance the Marketing Union.

Plant Protection (Tobacco) Rules, 1950—G.N. No. 168 of 1950—requires tobacco planters to adhere to planting, uprooting, and burning dates, and to control tobacco pests. Tobacco shall be stored and fumigated if necessary, in proper weatherproof buildings.

The Tea Ordinance, 1950, provides for the establishment of a Tea Board, the regulation of the planting and export of tea, and the imposition of cesses on tea. It replaces the old ordinance, and more or less conforms with similar legislation in Kenya and Uganda.

The Sisal Industry (Amendment) Ordinance, 1950—G.N. No. 24—allows the imposition of a cess on sisal and sisal estates.

The African Agricultural Products (Coffee) (Moshi District) Order controls and regulates the marketing of African-grown coffee through the Moshi Native Coffee Board.

The Cotton (Uprooting and Burning) Order, 1950—No. 191 of 1950—allows for control of uprooting and burning of all cotton residues in an attempt to reduce pest and disease incidence.

The Cotton (Amendment) Ordinance—No. 28 of 1950—controls the buying of cotton and regulates the use of proper weighing scales.

The African Agricultural Products (Coffee) (Bukoba District) Order—No. 71 of 1950—applies to marketing of produce and growing of coffee which shall be controlled by the Bukoba Native Coffee Board.

Publications

Articles sent to the Editor, *East African Agricultural Journal* for publication during the year 1950 were as follows: -

April issue :—

"The Construction of Pneumatic-Tyred Vehicles on the Farm" by C. G. Clegg.

July issue :—

"The Preparation of Nursery Beds and the Sowing of Coffee Seed" by L. M. Fernie.

October issue :—

"Small Earth Dams for the Irrigation of Rice Fields" by M. Lunan.

"Mound Cultivation in Ufipa, Tanganyika" by M. Lunan.

"The Biology and Control of the Cassava Scale" by G. Swaine.

In addition the book *The Agriculture of the Cultivation Steppe* and its Kiswahili translation *Mambo ya Ukulima* has been revised and issued as a new reprint. Copies of both are on sale and have been issued to all Instructors of

the Department. The book was written by Mr. N. W. Hosier, Deputy Assistant Director of Agriculture, Lake Province, assisted by members of the Department and the Empire Cotton Growing Corporation.

The following publications were made during the year :—

Departmental Pamphlets

46. "A Soil Conservation Study in the United States of America" by D. Thornton.
47. "Fourteenth Annual Report of the Coffee Research Station, Lyamungu, Moshi, 1947" by F. R. Sanders.
48. "Fifteenth Annual Report of the Coffee Research Station, Lyamungu, Moshi, 1948" by F. R. Sanders.
49. "Modern Methods of Rendering Beeswax" by F. G. Smith.

Entomological Leaflets

Pamphlet 20. White Borer in Coffee.

Bulletin 21. The Control of Antestia.

Leaflet 22. Insects [illegible] Horticultural Crops in Tanganyika.

Mycological Circulars

26. Tanganyika Fungus List : Recent Records No. XIII.
27. The Inoculation of Leguminous Seeds.
28. Pink Ear Rot of Maize.
29. Tanganyika Fungus List : Recent Records No. XIV.

Conclusion

This Report would not be complete without recording an appreciation of the keenness and loyalty displayed by the whole staff of the Department during the course of the year. New responsibilities were accepted with a will and the steadily increasing spate of correspondence, though extremely irksome, was efficiently despatched in spite of a depleted staff which was inadequate both in numbers and in standard of training.

Thanks are due to the staff of the Administration and technical departments for their co-operation in the furtherance of joint projects, and also to those members of the public who gave so generously of their time to serve on Boards, Production Committees and other bodies set up for improving the agricultural organization of the Territory.

C. E. J. Biggs.
Director of Agriculture

SECTION III.—TECHNICAL AND SPECIALIST REPORTS
EASTERN AND CENTRAL PROVINCES

Introduction

The Regional Assistant Director of Agriculture, Morogoro, was responsible for the Agricultural work in both Provinces. In this he was assisted by the Provincial Agricultural Officer, Dodoma, to whom the Agricultural staff in that Province were responsible. The arrangement has worked well owing to the ready co-operation of the Provincial Administration and Departmental staff of both Provinces. Mention should also be made of the excellent work done by the African clerks employed in the Regional Assistant Director's office and in the office at Dodoma, who worked hard to cope with a steadily increasing volume of correspondence. (In the Regional Assistant Director's office, there were 4,098 outward letters compared with 2,863 in 1949).

The bright features of the year in the Eastern Province were the bumper maize crop produced alike by Africans and Planters in Kilosa, Bagamoyo and Ulanga Districts, the very large paddy crop marketed in the Rufiji, the record castor crop in the Kilosa District, the sound start made in the Uluguru Land Usage Scheme, the increasing interest taken by African cultivators in the mechanical cultivation units operated by the Native Authorities in every district in the Province, and the foundation which has been laid for the expansion on a considerable scale of departmental mechanization schemes for the production of grain crops in various parts of the Province.

In the Central Province full advantage was taken of the satisfactory crop season to fill the Native Authority grain silos and no less than 6,850 tons of grain was collected by a communal grain levy, an achievement on which all concerned are to be congratulated. There was also a gratifying increase in the amount of contour banking carried out this year amounting to 557 miles equivalent to four times that done in the previous year. Great headway was made in Kondoa District whilst Singida District continued with the excellent progress of previous years. Much valuable data was produced by the World Agricultural Census, in particular the increased yields obtained by the interplanting of different cereal crops.

Climatic Conditions

Fortunately for both Provinces the preceding year's record drought was followed by a year of good rainfall. In the Eastern Province the total rainfall for the year was slightly below average in most districts but the distribution during the crop growing season was very satisfactory. The short rains did not break until late in December, 1949, but continued satisfactorily until the advent of the 1950 long rains. In the Central Province, as so often happens, the rainy season was broken by several severe spells of dry weather which either necessitated re-planting of crops or considerably reduced crop yields.

(a) *Eastern Province*

In a normal year the Province produces a surplus of food crops of approximately 8,000 tons including maize, sorghum, paddy, dried cassava and pulses which, added to the surplus Estate-production of some 1,000 tons, goes far to meet the requirements of rationed labour and urban dwellers. In Kilosa District alone, sales of Native-grown maize amounted to 4,000 tons whilst Estate-production of maize reached approximately 10,000 tons of which 2,166 tons were sold to the Department of Grain Storage. Over 3,500 tons of paddy were marketed in the Rufiji District with a further 2,000 tons in Ulanga District.

Approximately a further 3,000 tons of maize were sold in Native markets in other districts in the Province. The heavy rainfall towards the latter end of the season did not suit pulses such as cowpeas, grain and mixed beans, the yields of which were poor.

(b) *Central Province*

The Provincial Agricultural Officer reports that "generally speaking the Province managed to cope well with the food shortage caused by the poor harvests of the 1949 season. In the past famines have cost the Native Treasuries and Government considerable sums of money in the supply of free food. Prior to the maturing of the 1950 harvest, people were encouraged to buy food through the trade and to sell stock in order to obtain the necessary cash. By this means, by inter-district movement of food, and by utilising 5,300 tons of grain held in the silos, the Province managed to get by with only negligible amounts of free issues of food. Food supplies by the Grain Storage Department between July, 1949, and April, 1950, amounted to 9,500 tons of food so that together with the silo reserves the total amount of food consumed amounted to 15,000 tons approximately. The position at the end of this year is satisfactory and provided no major calamity such as locusts or drought strikes the Province, food reserves should be adequate until the 1951 harvest."

The reserves of food held in the grain silos at the end of the year were as follows :—

District	*No. of Silos*	*Quantity of Grain*
Dodoma	33 ...	1,740 tons
Singida	61 ...	2,670 tons
Kondoa	30 ...	1,420 tons
Mpwapwa	14 ...	750 tons
Manyoni	8 ...	270 tons
Total ...	146 ...	6,850 tons

Prior to the commencement of the grain levy this year all silos were emptied, cleaned and fumigated with "Gammexane" Smoke Generators. The cost of this per silo was approximately Shs. 3/22. This proved very effective not only against insect pests but rats and bats also. All grain from

the 1950 levy put into the silos was treated with B.H.C. (Kensil G.025) at the rate of 8 ounces of ·025 per cent B.H.C. in Diatomite per 200 lb. bag of grain. This work was carried out by the Field Staff of the Department in each district. The "pepper pot" method of treating the grain was used. In addition experimental silos were treated with B.H.C. for the top and bottom 3 ft. of grain only and one silo was left untreated as a control, to assist the Entomologist when he makes a detailed inspection of the silos during the coming year.

Native Food Crops in Detail

(a) *Eastern Province*

Paddy.—Throughout the Eastern Province exceptionally good crops were harvested, 3,902 tons being marketed in the Rufiji and 2,093 tons in Ulanga District. Considerably more paddy could have been marketed in Ulanga District but until road communications are greatly improved it will always be difficult to extract the full marketable surplus of food stuffs from this district. There is a pressing need for the construction of permanent bridges and concrete drifts on the major district roads south of the Kilombero River and for a ferry that will take fully-laden lorries across the Kilombero River on the main Ifakara/Mahenge Road. Apart from the difficulties of road transport it will also be necessary to control the excessive amount of beer that is brewed from paddy in this district. These two factors are probably responsible for the loss of 1,500 tons of paddy in a normal year. In Morogoro, Bagamoyo and Kisarawe Districts sales of paddy were small by comparison but it is impossible to estimate what proportion of the marketable surplus was transported illicitly to Dar es Salaam, Zanzibar and local Indian bazaars.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in Tons ...	427	6,030	2,174	1,571	6,431
Hand-hulled rice	123	414	281	22	133

Maize.—In Morogoro District there was a satisfactory crop which would have been greater but for continued rain in May and June. In Kilosa District planting took place earlier than usual owing to the general shortage of food. This resulted in a record Native crop of almost 4,000 tons. There was very little disease except in late-planted fields which were heavily infected with leaf streak virus. In Ulanga District a record crop of 815 tons was marketed. In Bagamoyo District although there was a considerable increase in acreage the crop was reduced by heavy consumption of green maize on the cob owing to the general food shortage and by excessive rain when the crop was maturing. Even so, a record crop of 920 tons was marketed and it is estimated that a further 200 tons would have been sold had the requisite storage space been available at Ngerengere.

	1946	*1947*	*1948*	*1949*	*1950*
	*	*	*	*	*
Production in tons	1,920	12,347	9,381	2,188¼	18,885

(*Inclusive of total Estate production and Native sales on markets).

Sorghum.—A bumper crop was harvested in Morogoro District, the continuation of the rains suiting the crop to perfection. In Kilosa District a very large crop was harvested but little was sold as it is a staple food taken in both liquid as well as solid form. The Agricultural Officer reports that "the controlled price was better than that offered last year but still considerably below that obtainable if sold locally in the villages". The crop is well suited to many parts of the Province but its popularity would be increased if a short-stemmed, bird-resistant, palatable variety could be introduced. All introductions tried hitherto have failed for one or other of these reasons. In Ulanga District there was a substantial increase in the acreage of this crop.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	103	1,333	1,095	345	774

Bulrush Millet.—The Agricultural Officer, Kilosa, states that "the millet crop was also large but little has found its way on to the markets. In the millet-growing areas all cash requirements have been met from the sale of castor seed. This is excellent as there are now large food reserves in areas which are normally threatened by famine".

Vegetables.—Production declined in Morogoro District due to the heavy rainfall at the beginning of the main planting season. Delays in arrivals of bulk orders for vegetable seed also contributed to the reduced production and an attempt is being made to produce seed of "Meteor" pea, cabbage, lettuce, carrot, beetroot and "blight-free" potatoes at the Native Authority farm at Zagila situated at an altitude of 6,000 ft. in the Western Ulugurus.

In Kilosa District the Agricultural Officer reports that "the vegetable scheme started at Kidete progressed during the year. The growers were formed into an association and agreed to sell through an appointed agent only. A cess of one cent per kilo was deducted from all sales for the purposes of building a packing and grading shed, furrow repairs, purchase of sprays and insecticides, and the purchase of cheap seed, which was sold at cost price to the growers. It was possible to sell seed of Broad Beans at Shs. 2 - per lb. and other vegetable seeds at Shs. 1/- per ounce. The cess was also charged on the onion crop which was also marketed through the association. Up to the end of November Shs. 540 - were collected in cess money and it is estimated that Shs. 19,000/- will have been paid to the producers during the period June to December for their onions and vegetables. Individual baskets are supplied to Europeans in Kilosa and vegetables in bulk to the hotel at Kimamba for retail to planters and others. The bulk of the produce however goes to Kongwa but arrangements have been made for bulk sales in Dar es Salaam should the demand from Kongwa decline.

The growers experienced attacks from many and varied insect pests all of which were combated with insecticides purchased through the association.

If the control at present exercised over the members of this association is maintained this project will prove of inestimable benefit alike to growers and consumers; but an essential to its success is that the liberty of the indivi-

dual must be subordinated to the general good of the association until it has developed into a stable organization.

	1946	*1947*	*1948*	*1949*	*1950*
Morogoro District	473	408	644	775	604
Kilosa District ...	300	292	200	190	250
Total ...	773	700	844	965	854

Dried Cassava.—The area under this crop in all districts is considerable particularly in Kisarawe, Morogoro, Bagamoyo and parts of the Rufiji and during the year considerable expansion took place in Ulanga District. In Kilosa District the aim is to establish one-acre plots for the distribution of planting material in all villages, for which purpose mosaic-free planting material is being multiplied at the Native Authority Farm near Kilosa. In Kisarawe District the Agricultural Assistant reports that, after heavy lifting of this crop during the previous year, with the co-operation of the Provincial Administration, a record acreage of cassava has been re-established in Uzaramo. In Uzigua Chiefdom of Bagamoyo District the acreage under cassava has declined as a result of propaganda by a small section of political malcontents.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	155	470	237	523	19

Dried Fish.—524,000 dried fish were sold through the Native Authority market established at the Kilombero Ferry near Ifakara. The bulk of the crop is purchased by itinerant traders who dispose of it at an exhorbitant profit in neighbouring districts.

Other Food Crops

Sales in Tons :

	1946	*1947*	*1948*	*1949*	*1950*
Mixed Beans ...	101	341	358	338	133
Cowpeas	80	298	156	147	187
Green Gram ...	16	120	70	47	33
Pigeon Peas ...	22	1,923	158	95	751
Onions	153	89	111	150	263
European Potatoes	222	82	73	120	118

Poor yields of pulses were obtained in all districts and, owing to the crops being uncontrolled, prices in district markets reached the record of £12. 10s. per ton. In recent years the production of potatoes has declined in Kilosa District owing to the prevalence of Late Blight *(Phytophtora infestans)*. In Morogoro District a satisfactory crop was harvested though rather smaller than that of last year. The potentialities of this crop in the Eastern Province mountain areas will not be realised until blight-resistant varieties can be found.

(b) *Central Province*

The Provincial Agricultural Officer, Central Province, reports as follows :—

"In Dodoma District most of the plantings were effected before the rains broke at the end of December. They suffered set-backs from several dry spells and with the early cessation of the rains only a moderate

harvest was obtained. In Singida grain crops yielded fairly well particularly on the Iramba Plateau. In Kondoa initial plantings were destroyed by drought during December, whilst second plantings were destroyed by infestations of Army Worm. In some areas as many as eight plantings were made before crops were established by the end of January. The practice of inter-planting grains with pulses and pumpkins was very successful this season. Little growth is made by these inter-planted crops until the grain crops have been harvested, after which they soon spread over the field and good yields are harvested in July and August. In Mpwapwa due to last year's food shortage preparation and planting of fields was completed in good time. Re-plantings were only necessary in isolated areas. In Manyoni satisfactory crops were harvested in the Western areas whilst elsewhere in the district they varied from average to poor."

Cassava.—The Provincial Agricultural Officer, Central Province, reports "the 1949/1950 season saw the beginning of the Provincial policy of building up communal cassava blocks as a reserve measure against future famines. In Dodoma District 10-acre blocks were established in fourteen Chiefdoms and planted up during the first week of the rains. Difficulty in obtaining sufficient planting material and adequate transport resulted in much of the material being too dry before it was planted. The dry weather in January and February combined with damage from termites resulted in a thirty to fifty per cent loss. The programme however is being maintained and several consignments of mosaic-resistant planting material, originally obtained from Amani and multiplied at Morogoro, were dispatched to the Central Province in the last few weeks of the year. The Agricultural Officer, Dodoma, reports that the greatest measure of success was obtained in low-lying sandy areas with a fairly high water table.

In Singida District the general progress of the cassava campaign was very satisfactory and the district now has approximately 300 acres of cassava, established in twenty-five blocks, as a source of planting material for the district and further blocks are being added this coming season, to be planted with mosaic-resistant material from Morogoro.

In Kondoa District the cassava campaign has been a great success and fifty-four ten-acre blocks were established of which only one proved a failure.

In Mpwapwa and Kongwa Districts considerable losses occurred from termites and it is estimated that less than thirty per cent of the original material survived. Further material was received in February, most of which survived until the dry season when further damage occurred from termites. A further 185 acres have been prepared in Mpwapwa and 88 acres in Kongwa for planting during the coming season.

In Manyoni District an intensive and extensive programme of cassava cultivation was instituted by the District Commissioner invilving the construction of fenced and ditched blocks totalling 1,153 acres. Planting material was obtained from Tabora, Kigoma and Morogoro.

Sweet Potatoes.—The establishment of communal sweet potato plots is also being undertaken in all districts in the Province in order to increase the reserves of anti-famine foodstuffs. Shortage of planting material is at present a limiting factor in many areas.

Native Cash Crops

(a) *Eastern Province*

Cotton.—The basic price paid to the growers was increased by two cents, prices in district buying posts ranging from fifty-five to sixty-one and a half cents per kilo for first-grade seed cotton. Except in the Rufiji District and Southern Morogoro, serious losses were incurred owing to American bollworm attack and in many parts of the Province plagues of field mice caused further losses. With the high prices being paid for tobacco, castor, sunflower and other crops, which do not involve the labour of hand sorting into grades, cotton cultivation is not expanding as it should do along the Central line. American bollworm (*Heliothis armigera*) and Cotton Stainer (*Dysdercus* spp.) continue to be major pests of cotton in the Province. American bollworm probably causes an annual loss of as much as 3,000 bales of cotton lint, whilst Stainers reduce the value of fifteen per cent of the crop to a quarter of its market value.

This season's plantings generally were more extensive than in the previous year and had more effort been made by Natives in harvesting their crop considerably more cotton would have been marketed. Delays in harvesting resulted in greatly increased damage by field mice, but growers appeared to be unconcerned and made little attempt to harvest their cotton at the proper time. Food was abundant and beer plentiful and growers, having obtained their cash requirements from sales of paddy or maize, lost interest in their cotton, the more so as it involved the trouble of grading. The African appears to be unable to appreciate the fact that the proportion of stained cotton increases as the season advances and therefore the longer he procrastinates his picking the more tedious becomes the task of sorting the cotton into grades. This season the crop which matured during the first few weeks was exceptionally free from Stainer attack and had it been harvested quickly would have required very little sorting to produce Grade A seed cotton.

The price received by non-native growers for ungraded seed cotton was equivalent to an increase of fifty cents per kilo above the price paid to native growers, the non-native planters having declined to participate in the price-stabilization fund which has been established for native growers, preferring instead to take the full price for their cotton. Having "made on the swings", they then proceeded to "gain on the roundabouts" by purchasing as much native cotton as they could induce natives to bring to secret buying posts at night. Out of a total crop of ungraded planters' cotton amounting to approximately 3,422 bales, it is estimated that approximately 1,200 bales were native-

grown cotton which had been purchased illicitly. This action created a serious shortage of trade A lint and seed and consequently had to be alternative was to insist that in future all cotton produced shall be sorted into Grades A and C. This decision came as a shock to planters who had for many years enjoyed the privilege of selling their cotton as ungraded "seed" cotton. In Uganda During the season of the rains resulted in much of the crop being planted too late and although the average ginner cotton was extensive the quantity of cotton marketed was disappointing mainly due to the illness of growers who preferred to spend their time drawing cotton and to hold more which played havoc with the unpicked cotton in the fields. In Bugesera the area planted was smaller than in 1949 and the combination of unfavourable weather, insect pests and field mice reduced the crop by almost fifty per cent. In the Mubuga District an excellent seed crop was marketed, the percentage of second cotton amounting to only four per cent of the total crop. Considerable damage however was done to cotton in the Western Rufiji by rats and much of the crop was lost owing to the lethargy of the growers.

	1946	*1947*	*1948*	*1949*	*1950*
400 lb. in bales ...	6,224	6,631	6,079	9,620	5,725

Copra.—The 1951 drought materially reduced the copra crop, particularly during the latter half of the year. To a certain extent this was offset by the higher standard of cultivation practised by growers as a result of departmental propaganda during the past few years. This year it was particularly noticeable that owners who had practised improved methods of plant sanitation obtained yields in the vicinity of double those of their less progressive neighbours. Much remains to be done in this direction however and the full-time services of a European officer are needed to continue sanitation work in the coastal areas of the Province. The preparation of copra of good quality continues to be one of the biggest problems in getting the industry on a sound footing. With this season's shortage of copra a considerable proportion of the crop, particularly in Kisarawe District, was sold in the "Black Market" and as the open market buyers were only too willing to accept copra of indifferent quality.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	4,637	2,193	4,764	9,388	5,508

Tobacco.—This crop is slowly increasing in popularity, particularly in parts of Morogoro District, where it is frequently planted in small plots adjoining native homesteads. At Mahenge trials with fire-cured tobacco continued. Only seventy Africans in the vicinity of Mahenge planted tobacco and these were taught to cure their leaf over the fires in their own houses. New nurseries have been established at Kibaraga, Mahenge and Ulanga in readiness for the coming season in the hope that an increased interest will be taken in this crop. The total production of flue-cured leaf at Mahenge amounted to 807 kilos on the Government experimental plot, and 641 kilos produced by African growers.

Other Cash Crops

Sales in tons

		1946	*1947*	*1948*	*1949*	*1950*
Arrowroot (Tacca Starch)	...	3	121	82	24	117
Beeswax	...	10	6	7	5	—
Cashew Nuts	(a)	218	347	661	444	1,117
Castor Seed	(b)	342	698	850	690	1,046
Charcoal	(c)	1,107	1,925	2,806	3,270	4,504
Gum Copal	...	57	59	26	36	68
Raffia Fibre	...	75	84	21	7½	9
Sesame	(d)	224	201	355	238	232
Sunflower	(e)	—	—	117	405	623

Notes—

(a) Cashew Nuts are mainly produced on Mafia Island and in Kisarawe District.

(b) Castor Seed again proved a good source of income for the people of Northern Kilosa and enabled them to acquire adequate reserves of grain this season.

(c) The production of charcoal is included to indicate the increasing rate of forest destruction that is taking place in Kisarawe District in order to supply the needs of the Dar es Salaam Municipality.

(d) The production of Sesame is confined mainly to the Rufiji and Kisarawe Districts.

(e) This was a poor season for Sunflower but with the high prices prevailing an increasing interest is being taken in this crop in Kilosa District.

(b) *Central Province*

The Provincial Agricultural Officer, Central Province, gives the following information with regard to cash crop production :—

Groundnuts.—1950 saw an improvement in production over the previous season, but even so this is still far short of that in previous years, when for example 3,511 tons were produced in 1942.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	721	1,677	994	43	383

Onions.—Onion production increased markedly and over 640 tons were sold during the year, beating the 1947 record of 415 tons. The bulk of this crop comes from Singida District. The demand for seed in all districts is increasing year by year and the crop may well become one of major importance in this Province.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	174	415	296	156	640

Potatoes.—The crop is never grown on any large scale and though efforts have been made to re-establish it on the Wota Plateau these met with little success as the people preferred to eat rather than plant the seed supplied to them.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	56	61	20	15	13

Castor Seed.—This crop is increasing in popularity, particularly in the Kongwa and Mpwapwa Districts and, with prices reaching as much as Shs. 1·23 per kilo, is likely to continue so. The 1950 crop constitutes a record for the Province. Efforts are being made to popularize this crop in districts such as Manyoni, where the cash economy of non-stock owners is generally low.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	94	306	473	333	651

Gum.—Sales showed a satisfactory improvement on those of recent years. Dodoma and Singida continued to be the main gum producing districts. Production also appears to be starting in Manyoni and Kondoa Districts.

	1946	*1947*	*1948*	*1949*	*1950*
Sales in tons ...	182	106	76	132	264

Beeswax and Honey.—Honey production increased this season, while that of beeswax was a little less. The honey increase was largely due to good sales in Kondoa, where some twenty tons were purchaed this season. At present great losses in the bee population occur due to the African methods of extraction, where the bees are often left to die. It was discovered during the year that pure beeswax was being adulterated with "Pula" wax, the wax of the Stingless Bee. The position has now improved as a result of the action taken by the Beeswax Officer, Tabora.

Sales in Tons :

	1946	*1947*	*1948*	*1949*	*1950*
Wax	30	40	92	9	8
Honey	57	185	175	10	38

Sunflower.—This is the third season in which sunflower has been grown and a slight increase in production was recorded, chiefly in Mpwapwa District, where the Agricultural Assistant states that although a smaller acreage was planted greater quantities were marketed. The earlier crop was of poor quality, while that harvested later was heavier and contained fewer "blind" seeds. During the latter part of the year the price rose sharply with an increase of £17 per ton when it reached a maximum of £37 per ton.

	1948	*1949*	*1950*
Sales in tons ...	182	192	202

Other Minor Crops

Cowpea.—Fifty-five tons were produced in Kondoa District for the first time since the record crop of 305 tons in 1947.

Physic Nut.—One hundred and twelve tons were sold in Singida. This is a popular crop as harvesting is easy and the crop grows wild near the homestead. However it is a crop which should be discouraged owing to the danger of it being mixed with castor or sunflower seed.

Non-Native Agriculture

Eastern Province

Maize.—Estate maize did well, particularly in Kilosa District, where estates were advised to plant short-term maize instead of the long-term Kenya types of maize. Yellow maize seed was imported from an estate in Moshi District and is reported to have yielded very well. The Agricultural Officer states that on one estate it yielded 9·8 bags per acre with a two-thirds stand inter-planted with sisal, whereas "Kenya Hybrid" maize yielded only 5·5 bags per acre. It was also found that two bags of cobs of yellow maize yielded one bag of grain, whereas three bags of Kenya maize were

required to produce one bag of grain. All the sisal estates in Kilosa District and several in Morogoro District produced enough maize to feed their own labour and at present large reserves of maize are being held by estates.

The standard of cultivation by many of the Asian planters is very poor and in many cases amounts to merely cleaning off the weed growth with hand hoes and planting without any cultivation of the soil. The land is never rotated, the same crops being planted year after year. It is hardly surprising, therefore, that uneconomic yields are produced under such conditions. Frequently these so-called farmers make their living from a small shop which they keep on the farm. The main crops they produce are maize, inter-planted with cotton, and pulses such as cowpea and gram. Though maize yields were good this year cotton yields were poor and in the majority of cases pulses were a failure.

Cotton.—The quantity of cotton sold by planters in Morogoro and Kilosa Districts amounted to 2,422 bales (400 lb.) but, as pointed out earlier, it is doubtful if much more than fifty per cent of this was the actual produce of the planters concerned. The season was a bad one for cotton and yields were considerably below normal. Much damage was done by field mice and some planters who were unable to produce labour for picking suffered heavy losses. The Agricultural Officer, Kilosa, states that the amount of damage done by American Bollworm varied enormously throughout the district, one estate being quite free from attack whereas on a neighbouring estate the cotton plants would be devoid of bolls as a result of this pest. In general the uprooting and burning of cotton on estates was not carried out as promptly as usual and it was necessary to institute proceedings against 19 Asian planters.

	1946	*1947*	*1948*	*1949*	*1950*
Production in bales	385 ...	526 ...	1,126 ...	1,997 ...	2,422

Sunflower.—Production was negligible owing to the uncertainty of the price at the beginning of the season. With Government's insistence on the grading of cotton however it seems probable that many planters will resort to sunflower or castor during the coming season.

Sugar Cane.—The main cane growing districts of the Provinces are Kilosa, Morogoro and Ulanga. With few exceptions plantations have not recovered from the effects of the 1949 drought and jaggery production was lower than it had been for a number of years. The Agricultural Officer, Kilosa, reports that tests were made of a number of canes growing in the district and it was found that their sugar content varied enormously. Some canes were entirely uneconomic but as plantations contain such a heterogeneous mixture it would be extremely difficult to carry out effective roguing. Twenty new varieties of cane were introduced from Amani and multiplication on a small scale has been started with the varieties C.O.419 and C.O.421 which are said to do well near Kisumu under conditions similar to those at Kilosa. The standard of cane management by Asian farmers is far from good and they continue to ratoon until the plants have deteriorated completely. Cutting is often carried out when the cane has passed maturity.

Vegetables.—Production by Non-Natives has decreased during the year probably owing to the rise in price of jaggery and other foodstuffs which are more easily produced.

Sisal.—The production of sisal showed a slight increase compared with the previous year but a number of estate managers consider that production would have been materially higher but for the shortage of labour and the after effects of the 1949 drought. The majority of estates are in excellent order and many of them have established permanent labour camps and re-equipped themselves with new machinery.

To quote the Agricultural Officer, Kilosa "many new tractors and a considerable quantity of heavy clearing and cultivation machinery made its appearance on sisal estates which previously had been run almost entirely by hand labour". There has been a considerable increase in acreage during the year and a number of estates have been given extensions to their existing property.

Rubber.—Production on Sanje Estate totalled twenty-five tons compared with thirty-five tons in 1949, fifty tons in 1948 and forty-five tons in 1947

Alienation of Land

In Kilosa District 30 new farms of 500 acres each were alienated for Asian settlement in the Magole area. The land was allocated too late for cultivation to be undertaken during the coming season though some of the holders are making an effort and will probably plant small areas.

Agricultural Instruction and Education

The Indian School of Agriculture, Morogoro.

Under the guidance of the Principal, Mr. K. H. Advani, an Agricultural Officer of the Government of India, the School assembled on November the third when there were twenty-three students present. By December the sixth the full complement of thirty students had arrived, ten from Kenya and twenty from Tanganyika. Mr. T. K. Parry, Education Officer, joined the staff on the 10th November as owing to ill-health Mr. Advani had been forced to tender his resignation. The object of the School is to teach sound practical farming methods with the theoretical instruction in the classroom being designed to supplement this objective. In practical work the students have been clearing and cultivating two acres of land for vegetable production, whilst other practical work in the field has included the management of the citrus orchard, surveying, milking and dairy management, together with instruction in the maintenance and operation of the Ferguson tractor.

The staff and students have had to contend with many difficulties caused by the lack of buildings and equipment which could not be obtained in time. Although the electric lighting plant has been installed, as yet no contractor

has been found to carry out the requisite wiring. The lorry required to take students on visits to neighbouring estates has not yet arrived and the transport of rations and stores from the Township has to be carried out with the farm tractor and trailer. The students have shown a willingness to learn and to undertake hard manual labour which has exceeded the expectations of all concerned and reflects credit alike on them and the staff of the school.

Uluguru Land Usage Scheme

The three Agricultural Assistants who were selected last year in the United Kingdom arrived in Morogoro during January, 1950, and this year has seen a start in the implementation of the scheme. These officers are supported by an African staff of three Recorders and twenty-four Field Assistants, all of whom work under the guidance of the Executive Officer who is an Administrative Officer specially detailed for this purpose.

The Agricultural Assistants on arrival were given an intensive course of instruction in Kiswahili and then proceeded on a course of instruction in soil conservation at Mlalo and Tengeru. They returned to the district in April and started work on their respective Pilot areas. The Executive Officer in his annual review reports that as first step each officer started by undertaking a simple agricultural census in his Pilot area, the main factor emerging from this census was the difference in crops between the three areas in which the Agricultural Assistants were working. An incidental but highly important result of the census was that the officers obtained a thorough knowledge of the areas in which they were working and became known to the Africans living in those areas. The next task was an inspection, plot by plot, of all holdings in the Pilot areas in order to plan the future land usage of every plot. This confirmed the estimate made, in previous surveys, by the Agricultural Officer that approximately 50 per cent of the land will have to be closed to cultivation of annual crops. Land in the Pilot areas has been classified into (a) land which can be cultivated annually provided it is ridged, (b) land which can be cultivated annually provided it is terraced, (c) land to be planted with trees either timber or fruit trees, and (d) land where natural regeneration will be encouraged. The majority of land in the Uluguru is likely to fall into Category (b) which entails the hardest work of all. In the Matombo and Tangeni areas the digging of permanent terraces has started and the original reluctance of the occupants appears to have been overcome. One of the limiting factors in the construction of terraces is that the digging must be very closely supervised. In the Mgeta area the construction of permanent terraces will be based on the existing ridges and the first step has been to realign all ridges correctly on the contour. The problem of reafforestation of areas demarcated for tree planting has been divided into two spheres, firstly the planting of small plots, by individual growers who receive free issues of seed for this purpose, and secondly the planting of large blocks of land under a scheme for the commercial development of softwoods which has been prepared by the Forestry Department.

In the Matombo area, which is lower-lying and has a higher rainfall it is intended to concentrate on the development of the existing citrus industry and the development of other tropical fruits.

The Executive Officer in his annual report points out that the progress which has been achieved to date has been in comparatively small areas under European supervision. In the past when European supervision has been transferred elsewhere maintenance of work, already done, has not been carried out. To ensure future progress therefore, it is essential that adequate and, if possible the same European staff remain seconded to the scheme. The whole scheme is basically very closely connected with the Native Administration and depends for its success on the co-operation of the Waluguru themselves. The Scheme is only in its infancy at present but a satisfactory start appears to have been made.

Native Welfare

(i) Irrigation and Water Supplies

(a) *Eastern Province.*

The Kilangali Irrigation Scheme was enlarged during the year and the furrow carried through Mkata village to a point three and a half miles from the original intake. The old temporary weir however gave continual trouble and a new permanent weir and intake were constructed in accordance with designs prepared by Water Development Department. The new intake has a capacity of ten cusecs of water which should be sufficient for 1,000 acres of rice grown during the wet season. Communal blocks of land have been demarcated at Mkata and Kilangali and individual plots marked out within these blocks. The blocks have been tractor-ploughed with two Ferguson tractors belonging to the Native Authority, all ploughing fees being paid in advance. The Agricultural Officer reports that many Africans have asked for plots for onion growing under irrigation next season and it seems probable that a considerable expansion of cultivation will take place in this area.

The Mwassa Irrigation Scheme worked well during the year, only small repairs being required. The furrow was used to supply water for the Kidete Vegetable Growers' Association. The supply of water for the Lumuma Irrigation Scheme has dwindled in recent years and is now insufficient to meet the needs of the East African Railways at Kidete Station, the irrigation scheme in the Lumuma Valley and three Asian farmers who hold water rights below Kidete Station.

The furrow of the Msowero (Kidodi) Irrigation Scheme has been completed and will be in operation as soon as intake works can be carried out early in the New Year.

(b) *Central Province.*

In Dodoma district one new "Hafir" dam was dug at Chibol (Myumi), five new bore holes were sunk and six new windmills were installed in various parts of the district.

In Singida District two dams were constructed during the year one in North Wilwana and the other in the Kironda basin. The latter is designed to hold 20,000,000 gallons of water which otherwise would be lost as surface run-off in the Kironda River. The dam is a magnificent effort and all who have been connected with its construction have expressed their grateful appreciation of the planning, advice and technical assistance afforded by Messrs. Bichierri. It is proposed that similar dams shall be made in this area, for, not only will valuable water supplies be conserved, but the seepage from a series of such dams should be able to maintain a small flow of water in the Kironda River during the dry season. In addition soil erosion will be reduced since cattle will not need to travel to the river in search of water.

In Kondoa District much has been done to augment water supplies this year. A piped water supply has been constructed at Ovada in Usandawe for cattle and human consumption and a well has been brick-lined at Elase. In the Settlement areas adjoining the escarpment two pipe lines each about two miles in length have been carried out into the plain to enable cattle to be watered and grazed without tramping over the erodible fan slopes below the escarpment.

(ii) Tractor ploughing for African peasants in the Eastern Province, Rufiji District

The Native Authority Unit consisted of two International T.D.9 Crawler tractors, four Fordson Major Diesel-engined tractors, three of which were fitted with "Roadless" half-tracks, which were used in conjunction with John Deere "600" series disc-ploughs and Ransomes "Baronet" disc harrows. Early in the season the demand for ploughing was so small that serious consideration was given to disposing of the unit but as the ploughing season advanced requests began to pour in particularly from the coastal areas of the district where there was plenty of money from copra and floodplanted cotton. Ultimately it was not possible to meet all the demands made for ploughing, partly owing to the Africans' tardiness in applying for ploughing to be carried out and paying for it in advance and partly due to the frequent breakdown of the half-track Fordson tractors which were unable to stand up to the gruelling conditions. The total area ploughed for Africans in the Rufiji District amounted to 3,189 acres whilst a further 266 acres were ploughed in Kilwa District. The TD 9 tractors gave no trouble and proved ideal for this type of work. Where ploughing took place on virgin grassland there was a demand for disc-harrowing to be carried out at an additional cost and next season it is intended to tow 7 ft. disc harrows behind two of the ploughs where groups of cultivators required their land to be disc-harrowed. This will enable the combined cost of ploughing and harrowing to be reduced but will only be possible with the use of crawler tractors. It is intended to dispose of the three half-track Fordson Majors and purchase two more TD 9 crawler tractors. In the words of the Agricultural Assistant "If there is a good crop

next season there will almost certainly be a big demand not only for ploughing but also for harrowing. The Warufiji are always pleased to by-pass hard work and provided there is money available they will not hesitate to do so".

Ulanga District

A Native Authority unit consisting of two Massey-Harris 744 Diesel tractors, two 505 disc ploughs, one Ransomes "Baronet" disc harrow, a trailer and a 5-ton Bedford lorry was purchased this year with funds obtained from the Development Loan. 214 acres were ploughed and harrowed at a charge of Shs. 38/- per acre for individual Africans of which 130 acres were cultivated for Chief Towagale of Utengule. A much greater acreage could have been cultivated but for mechanical failure in both tractors and the inability to obtain the requisite spare parts. Natives whose land had been ploughed expressed satisfaction with the work done and it seems probable that this unit will be kept fully occupied throughout the next dry season. The vigorous lead given by Chief Towagale was most welcome and if arrangements can be made for his crop to be combine-harvested he has stated that he would like to cultivate up to 400 acres of paddy at Ifema between Utengule and Malinyi. This area is however completely cut off for six months in the year and in order to combine-harvest his crop it would be necessary to maintain the combine harvester unit at Utengule during the wet season in readiness for harvesting in June before the main road is open to traffic. Large expanses of excellent rice land could be developed in this area provided all-weather rail or road communications were available.

Kilosa District

Up to the middle of November not one acre had been ploughed nor had any request been received. Thereafter demand increased rapidly and it was necessary to purchase an additional Ferguson tractor and disc plough, and 336 acres had been ploughed by the end of the year on payment at the rate of Shs. 18/- per acre, and ploughing still continues.

Uzaramo District

One hundred and ten acres of black cotton soil were ploughed in the Kisiju Chiefdom with the old Rufiji Fordson tractor and a Ransomes "Dragoon" three-furrow disc plough obtained on loan from the Kingolwira Prison Farm. On previously cultivated land the ploughing was excellent. On virgin land however the soil was turned over in big lumps, requiring further cultivation before sowing could take place. The Agricultural Assistant reports that the ploughing appears to have been greatly appreciated, particularly by the women-folk who, in Uzaramo District, do all the cultivating of the rice fields. One woman is reported to have refused to cook any meals for her husband until he had paid for his rice fields to be ploughed.

Bagamoyo

Difficulty was experienced in persuading people to pay for the ploughing in advance and not until October was it possible to make a start at Mlingotini, where twenty-five people had paid their ploughing fees in advance. Once a

start had been made more and more people paid their fees when they saw what the plough could do. Ploughing was held up at different stages by rain and mechanical breakdowns. To date 188 acres have been ploughed and payments received for a further 116 acres, whilst further requests have been refused owing to the lateness of the season.

Morogoro District

One tractor and plough, the property of the Native Authority, was purchased with a view to encouraging cultivation of crops on the plains, thereby relieving the necessity for growing food crops in the Uluguru Mountains. The chief difficulty has been to persuade Africans to stump the land which they wish to be ploughed. To date the tractor has only been able to plough 100 acres. Interest in ploughing however is increasing and there is likely to be a considerable demand for this service during the coming season.

Pests and Diseases

Maize Streak.—This virus disease was not as prevalent in the Eastern Province as in the previous season, though the Agricultural Officer, Kilosa, noted that it was particularly prevalent in late-planted maize.

Grain Smuts.—Some head smut in sorghum was observed and dressing of seed with sulphur would undoubtedly be beneficial but in the past, when sulphur was supplied in quantity to native growers, the local gunpowder manufacturers did a roaring trade whilst smut in sorghum showed no signs of decreasing. The Provincial Agricultural Officer, Central Province, obtained interesting results from smut dressing trials carried out in three districts and the results are appended below.

Treatment	*No. of Smutty heads per acre*	*Yields per acre (Kilos)*	*Remarks*
DODOMA			
Nomersan ...	—	343 ...	Low yield due
Sulphur ...	2	460 ...	to poor and
T.M.T.D. ...	46	451 ...	unmanured
Control ...	1,036	251 ...	land.
SINGIDA			
Sulphur ...	11	212 ...	Yields low as
Nomersan ...	13	181 ...	were those
T.M.T.D. ...	14	154 ...	of other
Control ...	568	107 ...	plots on the N.A. Farm, owing to late planting.
KONDOA			
Sulphur ...	21	1,543	
Nomersan ...	83	1,672	
T.M.T.D. ..	905	1,350	
Control ...	2,806	1,269	

Army Worm (Laphygma exempta and *eriqua).*—Widespread attacks occurred in Kondoa District, and considerable damage was done in Kilosa District.

Coconut Beetle (Oryctes monoceros).—Further good progress was made in the clearing up of coconut plantations and bush during the year by the two officers posted to the Bagamoyo and Kisarawe Districts for this purpose.

Cotton Stainers (Dysdercus spp.*).*—Stainers did considerable damage to cotton particularly during the latter half of the season.

American Bollworm (Heliothis armigera).—This pest caused considerable damage throughout the Province particularly where cotton had been interplanted with or was growing in close proximity to maize.

Pink Bollworm (Pectinophera gossypiella).—No severe outbreaks were recorded this season but if control of this pest is to be maintained it is essential that no extensions should be permitted to the gazetted dates for uprooting and burning of cotton.

Onion Thrips (Thrips tabaci Lind).—Considerable damage was done to the onion crop in Kilosa District more particularly to onions grown from locally produced seed.

Leaf Spot (Helmenthosporium spp.*).*—Leaf spot on sugar cane was more prevalent than usual and presumably had a detrimental effect on the yields of jaggery.

Field Mice.—There was a plague of field mice throughout the Eastern Province and though poison baiting with barium carbonate was carried out in the worst affected areas it was not possible to bring the plague under control by this means.

Birds.—Birds do extensive damage to sorghum, millet and rice throughout both Provinces and a considerable number of man and child days are spent in protecting crops against these pests. It is of interest to note that at Wami where trials of introduced dwarf sorghums were undertaken an adjoining block of tall native sorghum was devastated by birds whereas the departmental plot of dwarf sorghums was not attacked. This would seem to indicate that birds have a preference for tall-growing sorghums and might enable dwarf sorghums to be grown with comparative immunity if a block of tall sorghum was planted in the vicinity to act as a bait. In the Central Province the Provincial Agricultural Officer reports that the Wagogo as is their custom destroyed large numbers of Weaver bird nests though these were not as prevalent as usual.

Striga.—By Government Notice No. 133 of 1950, Native Authorities were empowered to make rules for the eradication of Striga and a campaign to this end was undertaken in Kilosa District and in all districts in the Central Province.

Vermin

Pigs, baboons, monkeys, elephants and hippopotami continue to do widespread damage to native crops throughout both Provinces. In the Rufiji and Ulanga districts it is reported that hippopotami are taking an increasingly heavy toll of native crops. At Kitundu 100 acres of rice grown by the Native

Authority were completely destroyed by hippopotami. In Kisarawe, Bagamoyo and Morogoro, campaigns for poisoning, netting and hunting are organised seasonally but officers report that natives are becoming increasingly apathetic and expect vermin destruction to be carried out for them without their assistance.

Soil Conservation

(a) *Eastern Province.*—Progress with the Uluguru Land Usage Scheme has been dealt with earlier in this Report. In Ulanga District Native Authority soil conservation instructors continue to supervise the construction of narrow-based contour banks on individual fields. Elsewhere in the Province efforts continue to be concentrated on the exclusion of fire from the mountain areas, complete success being achieved in the Uluguru Mountains this year.

(b) *Central Province.*—The Provincial Agricultural Officer reports that there was an excellent increase in the amount of contour banking carried out this year, 557 miles of banks being constructed by communal effort compared with 143 miles in the previous year. Tie-ridging in Dodoma which was introduced on a large scale this year suffered a setback as crops grown on the flat gave higher yields and it seems possible that the poor results on ridged land were due to the more rapid drying out of the soil during the various long dry spells. Had manure and crop residues been incorporated in the ridges thus increasing the moisture-holding capacity of these light soils the results might have been different. Investigations into this problem are being undertaken during the coming season.

Reclamation, Resettlement

(a) *Ulanga Sleeping Sickness Settlements.*—These concentrations of population continued to prove their worth. The construction of improved markets in all the settlements has served to alleviate much of the delay and discomfort caused to people who brought their produce for sale. Excellent crops of rice and maize were harvested and a good crop of cotton could have been harvested had growers been willing to do so. Unfortunately for the cotton industry this crop matured after the paddy and maize had been harvested when the community as a whole, having paid their taxes and purchased their immediate necessities, relax and enjoy themselves in an endless round of beer parties. The African is perhaps fortunate in being so readily content with so little. Local traders could do much to stimulate the African to greater endeavours were they to stock their shops with attractive and more expensive and better quality goods. The average stock of goods in an up country shop consists of an assortment of cheap, uninspiring articles reminiscent of the penny bazaars of thirty years ago. What is required is a stock of such items as bicycles, gramophones, boots and shoes, waterproof capes, knives, etc. which would encourage Africans to produce more and at the same time to raise their standard of living. In this connection it is perhaps only fair to add that up-country traders who are willing to buy bicycles often experience great difficulty in obtaining them from Dar es Salaam agents who are only willing to supply bicycles in crates of twenty-five at a time.

(b) *Central Province.*—Eighty square miles of bush clearing were completed in the Sinoia district this year and it is reported that African settlers are now rapidly taking up land made available by this clearing. The Provincial Tsetse Officer states that in various parts of these clearings soil conservation measures are urgently needed to prevent the spate of new settlers from ruining the land, thereby causing them to migrate and allow the bush to regenerate.

No organized resettlement took place in Kondoa District this year but work was directed towards making the existing clearings safer. With improved water supplies people are moving into the clearings all along the foot of the escarpment and are moving further out into the plains. In Manyoni District the cleared area below the Kilimatinde escarpment is slowly being occupied by new settlers.

Protection of Stored Grain

The Department of Grain Storage undertook to carry out the large-scale treatment of grain with B.H.C. which hitherto had been undertaken by the Food Production staff of Agricultural Instructors in the Eastern Province. This year, however, these Instructors were required for work in connection with the World Agricultural Census. The magnitude of the task of protecting grain brought in for sale at district markets was not fully appreciated by those concerned with implementing it and at the start of the season much of the grain was ineffectively treated. It is considered that it would be uneconomic to maintain a separate staff of Grain Storage Instructors for this work and that in future years it should be left to the Food Production staff of Agricultural Instructors, until such time as adequate means of bulk storage and curing of grain can be undertaken by the Grain Storage Department. Admixture of grain with B.H.C. may not be ideal as a means of dealing with pests of stored grain but until better means are evolved this system should be maintained as the losses of unprotected grain are too large to be borne with equanimity.

In the Central Province losses from Grain Weevil (*Calendra oryzae*) in grain stored in the Native Authority silos was so great that steps were taken this year to treat the grain with ·025 per cent B.H.C. at the rate of eight ounces to 200 lb. of grain.

Mechanization Trials

Mechanized cultivation trials of rice were undertaken in the Rufiji and Kilombero Valleys and of dwarf sorghum on the Wami Plain. In the Rufiji Valley 200 acres of land at Kitundu was ploughed, disc-harrowed and drilled with paddy at varying rates per acre. Unfortunately, the major portion of the crop was destroyed by floods or was over-run by weeds and tall grass. The balance of the crop was harvested with a Massey-Harris No. 26 combine harvester obtained on loan from the Overseas Food Corporation. The machine worked well but considerable difficulty was encountered owing to the quantity

of green material which was harvested along with the paddy. Valuable information was obtained in relation to suitable and unsuitable varieties of paddy for mechanization.

At Lupiro in Ulanga District sixty-five acres of swampy land were cleared and planted with paddy at the rate of sixty pounds of paddy per acre using a normal grain drill. The seed-bed had been thoroughly prepared and very little competition from weeds was encountered. The worst weed was Buffalo bean. The yield per acre averaged 890 kilos of paddy but with some of the varieties grown which had drooping heads it is estimated that at least ten per cent of the crop fell in front of the cutter bar. The variety "Kahogo" which is a Faya type of paddy promises to be suitable for combine harvesting, particularly if further selection work is carried out on it. Two new strains of this variety selected by the Botanist, Ukiriguru, are being tested during the coming year. This trial has now been extended to cover 200 acres during 1951.

Trials of dwarf sorghums at Wami yielded poor results owing to the excessive water-logging that occurred in this area and further experimental work is needed before large-scale trials are warranted on the Wami Plains.

World Agricultural Census

In the Eastern Province the census was carried out in Ulanga, Kilosa, Morogoro, Bagamoyo, Kisarawe districts and Mafia Island. In the Central Province Singida, Kondoa, Dodoma and Mpwapwa districts were chosen. The entire work was carried out by the staff of African Instructors in both Provinces, who were divided into teams and trained in their duties as carefully as possible in the short time availabe. In the Eastern Province with its wide range of growing seasons the census was not completed in many areas until after the close of the year and it is not possible to comment on the results beyond noting that in a poor cotton season the yields for cotton plots worked out at about 600 lb. of seed cotton per acre which is very much higher than the average yield per acre reaped by growers. This indicates that if the meticulous picking afforded to small census plots of one-fiftieth of an acre were applied to cotton grown on a field scale the yield per acre would be much higher or, to put it another way, daily picking of the crop is essential if the maximum yields are to be obtained, a point which officers of this department have endeavoured to bring home to growers for the past quarter of a century with singularly little success in the Eastern Province, where procrastination in regard to cotton picking is the normal procedure. It is also of interest to note that in various districts yields of approximately one ton of paddy per acre were recorded, the highest yields being obtained on plots which had been mechanically cultivated.

In the Central Province the Provincial Agricultural Officer reports that "Many plots of pulses and groundnuts were destroyed by pests or had shed their seed before the teams got round to harvest and weigh. However in spite of many difficulties the work was well done and completed in August.

Data was abstracted from the yield recordings (also human and cattle figures) and from these average yields of the various crops in each area were worked out and tabulated. Yields in Ugogo are much less than those obtained in either Singida or Kondoa. There are also in Kondoa increased yields with mixed millets or sorghum as compared with pure stands of either. Yields everywhere were high, probably higher than in a normal year."

Kingolwira Prison Dairy Scheme

The Agricultural Assistant continued in charge of all farming operations until the arrival in April of the Senior Livestock Officer who became responsible for the general running of the scheme. In the management of the dairy he was helped by a Temporary Woman Dairy Assistant, whilst the problem of disease control was very ably managed by the Assistant Veterinary Officer.

The arable side of the scheme was once again managed very successfully by the Agricultural Assistant, and a record maize crop was harvested owing to a combination of satisfactory weather conditions and skilful farming methods.

The policy of clearing and stumping the bush outwards from the centre of the farm was continued, the object being to maintain a fly-free area of pasture in the centre of the farm, surrounded by a belt of arable land. With the advent of an additional European Officer, the Prisons Department took charge of the work of clearing and stumping in addition to the building operations connected with the scheme. The cropping plan was designed to plant an acreage sufficient to supply the needs of some 1,200 prisoners, the prison staff, and to provide cereals, silage, hay and grazing for the dairy herd. During the next few years considerable difficulty may be experienced in establishing adequate grazing on the over-cropped lands in the centre of the farm, and greater reliance will have to be placed on the provision of hay and silage, until a larger area of newly cleared land can be brought under the plough.

The following table shows the areas under various crops during the past two seasons, together with the yields per acre during the 1950 season.

Crop	1949 Area	1949 Yield per acre	1950 Area	1950 Harvested	1950 Yield per acre
Maize (Short Rains)	—	—	60	190 bags	3·2 bags
Maize (Long Rains)	320	1·7 bags	354	2,893 bags	8·2 bags
Sorghums (African)	100	1·8 bags	380	2,175 bags	5·7 bags
Sorghums (Dwarf)	—	—	20	14 bags	0·7 bags
Mixed Beans	—	—	10	15 bags	1·5 bags
Paddy	—	—	5	10 bags	2·0 bags
Panicum miliaceum	—	—	1½	4½ bags	3·0 bags
Cassava	17	—	25	10 tons	—
Sesame	1½	3·7 bags	60	nil	nil
Sunflower	60	2·2 bags	20	44 bags	2·2 bags
Cowpea	40	—	120	Made into hay	
Maize	20	—	85	Made into silage	
Vegetables	3½	—	3½	28·8 tons	8·2 tons
	562		1,144		

Prior to the arrival of the Farm's International T.D.18 Crawler Tractor, it was necessary to borrow the Caterpillar D.7 from the Experimental Station at Ilonga. The red earth soils on the Prison Farm whilst easily worked when moist, tend to set very hard, and have very abrasive properties during the dry season. At times even the three-and-a-half-ton Davis disc plough is unable to penetrate effectively. Data relating to fuel consumption and performance of the various tractors employed during the year on the farm are included in Annexure No. II to this report.

At the end of the year the dairy herd consisted of the following animals :—

Half-bred Boran/Freisian heifers and calves ...	114
Half-bred Boran/Guernsey heifers and calves ...	80
Grade Ayrshires heifers and calves	31
Pure Boran Bulls	8
Pure Boran heifers	35
Weaned calves	42
Unweaned calves	49

All adult stock passed the Tuberculin Test, were vaccinated against Rinderpest and were blood tested for Contagious Abortion.

During the period 7th May to 31st December, 1950, the total milk production amounted to 27,657 gallons of which 20,242 gallons were sent to Dar es Salaam, 1,432 gallons were sold in Morogoro, 2,192 gallons were sold locally and 3,508 gallons were fed to the calves. Losses in weighing and pasteurising amounted to 283 gallons.

The relatively small area of almost fly-free grazing combined with the poor quality of forage thereon, made it necessary to feed considerable quantities of concentrates and imported foodstuffs. The following table shows the quantities of imported foodstuffs consumed by the herd during the year :—

Cotton seed	2,200	cwts.	costing Shs.	13,643.00
Oil Cake	500	,,	,, ,,	2,496.00
Maize Meal	360	,,	,, ,,	6,300.00
Sorghum Flour ...	70	,,	,, ,,	1,225.00
Wheat Bran	370	,,	,, ,,	3,145.00
Lucerne Hay	400	,,	,, ,,	5,000.00
Molasses	25	,,	,, ,,	381.52
Bone Meal	6	,,	,, ,,	96.00
Salt	10	,,	,, ,,	55.00
Total ...	3,941	,,	,, ,,	32,341.52

This is equivalent to a gross cost of Shs. 1·18 per gallon of milk produced, in addition to which the value of home grown hay and silage amounted to Cents 44 per gallon, a total of Shs. 1·62 per gallon for feeding stuffs. Maintenance costs and direct labour charges are estimated to have cost Cents seventy per gallon, making a total of Shs. 2/32 per gallon to which should be added charges for management, depreciation on buildings and machinery, cost of transport of home grown feed and bedding to the dairy, the value of convict labour and a share in the costs of the water supply. Even after due allowance has been made for the fact that the scheme has barely got under way, it is obvious that the selling price of Shs. 2/- per gallon f.o.r. Kingolwira

Station is uneconomic, and will have to be increased considerably, particularly since railway freight charges amounting to Cents 33 per gallon have to be paid in advance. As matters stand at present, Government is in fact subsidizing the price of milk to Dar es Salaam consumers. Morogoro consumers pay Cents 40 per pint landed Morogoro which is eight cents per pint less than the controlled price for milk supplied by local producers.

Trypanosomiasis has been the main disease, and despite the numerous cases which occurred in the herd, only one cow was lost from this cause, which reflects considerable credit on the work of Mr. Matovu, the Assistant Veterinary Officer seconded to the scheme.

The following statistics relating to the monthly incidence of "flies" caught at the seven pickets, and the occurrence of trypanosomiasis are of interest :—

Month	*Flies caught*	*Trypanosomiasis cases*
January	420	... Incomplete records
February	463	... Incomplete records
March	342	... Incomplete records
April	509	 3
May	320	 33
June	323	 54
July	417	 63
August	573	 27
September	724	 33
October	722	 20
November	526	 30
December	451	 13

The number of fly-pickets was increased from four to seven in August, but even so there appears to be no correlation between the catches of fly and the incidence of trypanosomiasis. The efficiency of the "fly-catchers" is not known, and it seems probable that a great many undetected tsetse flies passed through the pickets on lorries carrying firewood for the brick kilns, the dairy boiler, etc.

In the writer's view the erection of expensive milking sheds is an unnecessary and expensive luxury, and open-sided milking barns (semi-permanent) would be more sanitary and economical, and yield just as many gallons of milk.

The arable side of the scheme was handed over to the Prisons Department on the thirtieth of December, and the dairy side will be handed over early in the new year. Viewed in retrospect, the year has seen a successful start to an ambitious venture—ambitious in that soil and climatic conditions and the presence of tsetse fly all combine to make mixed farming a difficult proposition. With sound farming methods and skill and care in combating disease, a successful start has been made, but conditions are such that mistakes in farming operations will prove very costly.

The progress recorded during the year could not have been achieved without the keenness of the Commissioner of Prisons, and the co-operation of Mr. S. B. Wright, the Superintendent in charge of Kingolwira Prison.

Morogoro Farm

The report of the Agricultural Officer, Morogoro, is attached as Annexure III to this Report.

Mahenge Tobacco Farm

Trials with Heavy Western fire-cured tobacco were continued. The quality of leaf was not as high as in the previous year, partly due to insufficient space in the curing barn. The total yield of tobacco cured leaf amounted to 807 kilos from three and a half acres, compared with 564 from one and a half acres in 1949.

Dodoma Farm

A small mixed farm is maintained at Dodoma on which some useful experimental work is carried out. Of particular interest this year was the sunflower manuring and spacing trial. "The outstanding feature", states Dr. A. H. Bunting, Chief Scientific Officer, "is the marked and highly significant increase in yields on the plots which received farmyard manure in the previous season amounting, at the six ton per acre rate, to 300 lb. additional seed per acre. Differences due to spacing are relatively small and do not achieve significance, although there is some tendency for the fifteen inch spacing to give poorer yields than either the nine or twenty-one inch spacings. I do not feel, however, that it is worth placing any emphasis on these small differences."

Summary of Results :
Seed lbs. per acre :

FYM (applied 1948–49)	Spacing in the row. *9"* (+ 75·7) a	*15"*	*21"* (+ 43·7) b	*Mean*
None	579	472	514	522
3 Tons per acre	721	681	693	698
6 Tons per acre	894	757	861	837
			(+ 43·7) b	
Mean	731	637	689	686
Significant differences	—	5%	1%	—
a	—	216	289	—
b	—	125	167	—

Central Province Tribal Seed Farms

The Agricultural Department contributes substantially to five trible seed farms in the Province. These serve a useful purpose providing ground for crop trials, seed multiplication, demonstrations of improved cultural methods and centres of instruction.

MISCELLANEOUS MATTERS

The Central Province Liaison Committee with the Overseas Food Corporation held two meetings, one at Kongwa and one at Morogoro, which provided for a very useful exchange of information and ideas. In addition to advice so freely given at all times, I wish to take this opportunity of thanking the

Corporation for the very great assistance which it has provided in the form of seed and machinery on loan as well as that sold to the Department.

Finally, I wish to place on record the ready assistance given to the Department at all times by the Officers of the Provincial Administration in the Eastern and Central Provinces, and by those technical officers, particularly in the Water Development Department, with whom we are continually in contact.

A. H. SAVILE,
Regional Assistant Director of Agriculture,
Eastern & Central Provinces.

ANNEXURE I TO ANNUAL REPORT FOR CENTRAL PROVINCE

B. Sales of Agricultural Produce in Central Province, 1950 (in metric tons)

	Price per ton to Producers	Dodoma	Manyoni	Kondoa	Singida	Mpwapwa	Kongwa	1950 Total	
	£								£
Foodcrops—									
Beans	15	—	—	—	—	14	—	14	213
Cowpea	15	—	—	57	3	—	—	60	1,309
Honey	60	5	6	24	—	3	—	38	2,288
Maize	10	—	—	—	—	3	—	3	30
Finger Millet	20	—	—	—	5	—	—	5	100
Onions	25	2	25	30	578	3	2	640	16,083
Paddy	15	—	20	—	—	—	—	20	303
Potatoes	31	—	—	1	2	3	7	13	230
Pigeon Pea	22	—	—	15	—	—	—	15	323
Salt	9	33	12	—	—	—	—	45	400
	—	—	—	—	—	—	—	853	21,279
Oil Crops—									
Castor Seed	45/10	16	2	30	12	69	523	652	29,817
Ghee	133	¼	¼	2	—	½	—	3	398
Groundnuts	21	—	—	5	311	50	17	383	7,940
Sesame	40	10	—	—	—	—	—	10	393
Sunflower	25	15	12	8	39	23	105	202	5,070
Physic Nut	9	—	—	—	112	—	—	—	1,015
	—	—	—	—	—	—	—	1,250	44,633
Other Crops—									
Beeswax	310	½	1½	3	1	½	1½	8	2,446
Gum	32	110	20	5	129	—	—	264	7,312
	—	—	—	—	—	—	—	272	9,758

ANNEXURE II TO ANNUAL REPORT FOR EASTERN PROVINCE

A. Statistics of Agricultural Produce in Eastern Province, 1950 (in Metric Tons)

	Price per ton to Producers	Ulanga	Kilosa	Morogoro	Bagamoyo	Kisarawe	Rufiji	Mafia	1950 Total	Approx. value to Producers	1949	1948	1947	1946	1945
Food Crops	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Beans, Mixed ...	22	—	131	2	—	—	—	—	133	2,296	338	361	341	101	265
Cashew Nuts... ...	80	—	—	—	—	564	3	553	1,120	89,600	444	661	348	218	347
Cassava	10	—	—	13	—	—	6	—	19	190	583	282	470	155	1,386
Cowpea	30	3	12	48	16	108	—	—	187	5,610	286	156	298	80	81
Gram	35	1	3	9	3	17	—	—	33	1,155	75	70	120	16	69
Jaggery	39	100	520	400	—	—	—	—	1,020	39,780	1,289	1,470	250	1,160	730
Maize, Native ...	10	815	3,940	951	920	259	419	—	7,284	72,840	590	4,847	5,747	1,920	4,369
Maize, Non-Native*...	12	—	10,000	2,000	—	—	—	—	12,000	144,000	1,598	4,504	6,600		
Onions	25	—	157	106	—	—	—	—	265	6,575	150	119	89	155	169
Potatoes	25	3	19	99	—	—	—	—	118	2,950	120	85	82	220	17
Pigeon Pea	25	1	—	12	22	319	95	—	449	10,327	95	200	1,925	22	114
Paddy	16	2,093	—	111	43	282	3,493	—	6,022	96,352	1,571	2,270	6,030	427	780
Rice Hand-Milled ...	24	38	48	20	5	- -	22	—	135	3,192	22	286	414	125	178
Sorghum	10	41	140	510	13	68	2	—	774	7,740	343	1,087	1,333	103	512
Tacca Starch... ...	10	—	—	-	—	117	—	—	117	1,170	24	86	121	3	153
Vegetables	15	—	250	604	—	—	—	-	854	12,810	965	840	700	773	724
Wheat	12	2	—	13	—	—	-	—	15	180	25	50	—	—	—
Dried Fish	20	130	—	—	—	—	—	10	140	2,800	32	187	—	—	—
Total ...	—	3,227	15,220	4,898	1,022	1,734	4,040	563	30,685	499,567	8,550	17,561	24,868	5,478	9,893

*Inclusive of maize grown by Estates for home consumption.

ANNEXURE II TO ANNUAL REPORT FOR EASTERN PROVINCE—(*contd.*)

A. Statistics of Agricultural Produce in Eastern Province, 1950 (in Metric Tons)

	Price per ton to Producers	Ulanga	Kilosa	Morogoro	Bagamoyo	Kisarawe	Rufiji	Mafia	1950 Total	Approx. value to Producers	1949	1948	1947	1946	1945
Oil Crops	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Castor Seed	50	—	1,040	—	6	—	—	—	1,046	52,300	690	865	698	342	268
Copra	40	—	—	—	1,250	1,470	797	1,991	5,508	220,320	9,388	4,841	2,139	4,637	5,448
Sesame	40	1	2	30	25	172	153	2	385	15,400	238	357	201	224	523
Sunflower	25	56	523	41	—	3	—	—	623	15,575	1,193	107	—	—	—
Total ...	—	57	1,565	71	1,281	1,645	950	1,993	7,562	303,595	11,509	6,170	3,038	5,203	6,239
Other Crops															
Coffee	500	—	4	118	—	—	—	—	122	36,600	—	—	—	—	—
Charcoal	50	—	—	—	—	4,504	—	—	4,504	135,120	3,270	2,806	1,925	1,107	1,269
Ginger	75	—	—	7	—	—	—	—	7	525	—	—	—	—	—
Gum Copal	32	—	—	—	6	13	49	—	68	2,176	36	54	59	57	27
Kapok	300	—	84	100	—	—	—	—	184	183,200	355	200	220	220	95
Raffia	150	—	—	—	—	5	—	4	9	1,350	8	21	84	75	67
Rubber Para. ...	350	40	—	—	—	—	—	—	40	14,000	35	50	46	—	—
Sisal	175	—	14,750	16,801	96	6,496	46	—	38,189	6,683,075	37,678	36,375	38,579	34,825	33,985
Seed Cotton—															
African A	30	306	610	605	332	5	770	—	2,628	78,855	4,830	3,067	3,061	2,468	—
African C	10	125	214	171	79	2	103	—	694	6,947	792	567	559	550	—
Planters	60	—	1,298	153	—	—	—	—	1,451	87,064	1,744	637	306	597	—
Tobacco	120	1	22	39	—	—	—	—	62	7,440	—	—	—	—	—
Salt	9	—	—	—	1,700	—	—	—	1,700	15,300	1,327	1,989	4,829	2,682	1,626
Total ...	—	472	16,982	17,994	2,213	11,025	968	4	49,658	7,251,652	50,075	45,766	49,668	42,581	37,069

Morogoro Farm, 1950

1. *General.*—The farm had a fair year with a number of changes due to the arrival of a tractor for the first time.

2. *Nurseries.*—The Nurseries continued to thrive under the very efficient management of Mr. Salehe Muhenga, the African Overseer. The following material was sent out during the year compared with the previous year : -

	1950	*1949*
Citrus fruits	5,078	8,711
Other fruits	2,281	4,918
Ornamentals	6,722	4,918
Total ...	14,081	16,386

3. *Crops.*—Crop produce despatched from the farm was :—

Maize	1,830 Kilos
Sorghum	240 Kilos
Coconuts	545 Kilos
Cassava Cuttings	1,343 Bundles
Edible Canna	10 Crates
Lemon Grass	5 Crates
Pawpaw Seed	7 Ozs.
Sweet Potato Tubers	1 Bag
Onion Seed	16 Boxes

Production of arable crops was as follows :—

Maize	4,220 Kilos
Sorghum	2,082½ Kilos
Paddy	211 Kilos
Sunflower	672¾ Kilos
Beans	60 Kilos
Cowpea	180 Kilos

4. *Dairy.*—The herd had a fair year judged by past standards. Some twenty-five tons of hay was taken off the golf course which did valiant service as feed during the dry season and enabled the herd to record the highest monthly yield of the year during October, a remarkable feat.

Milk production during the year amounted to :—

Milk sold...	15,169 pints
Fed to calves	12,191 pints
Total ...	27,360 pints

The condition of the young stock towards the middle of the year was poor, but considerable improvement resulted from the supervision afforded by Mr. R. J. Newbury, Agricultural Assistant.

Births have been	17	bull calves
	9	heifer calves
Deaths have been	17	bull calves (slaughtered)
	8	heifer calves
	3	old cows
	2	old oxen
	1	young bull calf was sold

The herd now carries no young bulls except those whose parentage warrants their retention as future sires.

During the year the whole aspect of the farm has changed by the arrival of two Ferguson tractors. In May we obtained the use of one Ferguson which enabled some twenty-five tons of hay to be made from the golf course in June. Other machinery were a two-furrow mould-board plough and two trailers.

With the limited amount of money available the following was bought :—

1 Five-foot mower.
1 Cultivator.
1 Earth-scoop.

An extremely sketchy set of spares. Nuts, Bolts and Gaskets, etc.

The second trailer arrived in November and did useful work ploughing and cultivating.

Lessons learned from the machinery to date are :—

1. That *Panicum Maximum* is not going to be a useful grass, as its tufted growth plays havoc with a mowing machine.

2. That the mould-board plough is useless except during the wet season as :—

   (a) It clogs badly where weeds and old stalks are present.

   (b) The shares wear very fast in dry ground.

3. That the cultivating operations will have to be carefully timed as the Ferguson cannot work on hard dry ground which can be done by ox-drawn implements even though the work is done roughly.

4. That the farm needs a large amount of adaption to machinery e.g. the bridges over the furrows need repairs, entrance to fields are too narrow.

5. The use of the tractor has been limited by the lack of implements, and for the purposes of 1950 it has been small comfort that we may get more money in 1951. It is a basic fact that to get best use from machinery it should run the maximum number of hours. The farm has been the loser because the excellent decision to provide a tractor was not at the same time supported by the necessary provision of enough money to purchase an economic range of implements.

6. *Fish Ponds.*—Work on these ceased halfway through the year due to lack of funds. Funds were later forthcoming but it was impossible to use the money since labour was unobtainable. Finally as a result of a decision by the Malariologist, the fish ponds had to be abandoned as they were situated within the township.

ANNEXURE II TO ANNUAL REPORT FOR EASTERN AND CENTRAL PROVINCES

Tractor performance data at Kingolwira Prison Farm—1950

Consumption in gallons

Operation	Tractor	Hours worked	Diesel	Petrol	T.V.O.	Lub. oil	Gear oil	Lbs. of Grease	Acres	Acres per hour	Fuel
Ploughing											
Davis	Caterpillar D. 7 ...	290	747	13	—	59	—	65	305	1·04	2·57
Davis	International T.D. 18 ...	667	1,857	49	—	55	5	118	953	1·42	2·77
Dragoon	Fordson Major	1,404	—	364	2,316	83	25½	300	916	0·65	1·92
Disc-Harrowing											
Roman	International T.D. 18 ...	45	118	1	—	1	—	4	60	1·33	2·47
Baronet	Fordson Major	837	—	71	1,392	29	3	161	580	0·69	1·75
Lightweight	Fordson Major	260	—	40	516	9	1	68	297	1·14	2·1
Mower	Fordson Major	269	—	41	277	9	1	15	164	0·61	1·18
Planting											
4 row	Fordson Major	97	—	7	132	3	½	24	185	1·91	1·91
Trailer	Massey-Harris	1,266	—	315	916	41	16½	35	—	—	0·99
	Fordson Major	2,207	—	380	1,949	65½	9	51	—	—	1·29
Stumping	International T.D. 18 ...	143	328	8	—	12½	—	22	—	—	2·3
Combine-Harvesting ...	Massey-Harris 26 (12 ft. cut)	194	—	366	—	9	—	56	—	—	1·89

WESTERN PROVINCE 1950

Climatic Conditions

Rainfall recorded during the crop season October 1949—September 1950 was in many cases below the average annual figures of rainfall as shown in the records published by the British East African Meteorological Service. The distribution of the rainfall obtained during the 1949-50 crop season was better than in the previous "drought" years of 1948 and 1949 and as a result quite good crops were reaped in many areas. Rainfall for the period October-December 31st, 1950, was far higher than the averages of previous years and as a result the 1950/51 crop season has started off well.

Food Crops and Food Supplies

The two "drought" years of 1948 and 1949 made severe inroads on any carry over of foodstuffs from the 1947 harvests and in addition cassava reserves were in many cases reduced to perilously low acreages. The 1949 crops were so poor in Nzega that famine relief to the extent of £20,000 had to be supplied while in Mpanda the cost of famine relief food was £12,000. In certain parts of Tabora district, notably Sikonge, famine relief food had to be supplied while in other areas of Tabora district cereals were released by the Grain Storage Department for sale through normal trading channels. It is safe to say that where cassava crops were adequate there was no fear of food shortage but where cassava plantings were insufficient or where cassava was damaged by vermin (pig and monkey in the Eastern part of the Province or rats in Mpanda and Ufipa districts) food supplies were insufficient to meet local requirements and food had to be imported from other parts of the Province. It was fortunate that Kigoma district had ample quantities of cassava root and supplies were sufficient to meet the needs of Mpanda and Nzega districts.

For the 1950/51 planting season emphasis has been laid on adequate reserves of cassava planted preferably at the beginning of the planting season—instead of at the end since late-planted cassava makes little headway during the first year. Cassava can be planted at the very beginning of the rains when it is still too early to plant other crops for fear of a break in the rains. Bitter cassava (variety "Liongo") is being advocated wherever possible since it is not attacked to the same extent by wild pig and monkey. Plans have also been made to conduct a poisoning campaign against rats in Mpanda and Ufipa district.

Crop Production

(a) *Maize.*—The trend from sorghum to maize which received so much impetus in war-time when maize was in great demand compared to sorghum, continues. The poor soils of Unyamwezi are far from ideal for maize growing but where liberal amounts of farmyard manure are applied quite good yields

can be obtained. Also, maize planted in the period November-January generally yields far better than late-planted maize but in spite of this maize is planted right up to the end of the rains even although the cultivator is aware that he may reap little more than the amount of seed planted. The enterprising Chief of Ngulu decreed in 1950 that all rain-grown maize in his chiefdom should be planted not later than end-January with the result that excellent maize crops were harvested in his area. Yet the suggestion that this prohibition of late-planted maize should be extended to the whole of Tabora District was unhesitatingly rejected at the half-yearly meeting of Chiefs and elders held in August, 1950, although many of those present admitted that early-planted maize gave better yields than late planted. As far as the main-rains maize crop is concerned the best that can be done is to encourage manuring, to insist on tie-ridging of land and to continue to press for early planting.

The valley-bottom maize crop planted in the dry season came in most useful in providing a reserve of food to tide over the period until the 1951 crops started to come in. Particularly good crops were obtained in Kibondo, Kasulu and Kigoma. The amount of maize marketed in the Province during the past four years was (in tons) :—

1947		*1948*		*1949*		*1950*
2,203·3	...	3,438·3	...	848·0	...	3,377·5

(b) *Sorghum.*—As indicated above sorghum continues to be replaced by maize in most areas in spite of the fact that the price paid to the producer for maize and white-grained sorghum is the same. Most of the maize and sorghum grain is milled in hammer mills and while this may give a palatable meal in the case of maize, hammer mills are not the most suitable type for the milling of sorghum. The milling of the entire sorghum grain gives a meal with too high a fibre content to be acceptable to the average African consumer with the result that there is little demand for sorghum flour in towns and if maize meal is temporarily in short supply cassava flour is preferred to sorghum flour. Much could be done to make sorghum flour more popular by the use of suitable milling machinery : also the consumption of sorghum flour could be increased by mixing a small proportion with maize flour.

The types of sorghum at present grown in the province are far from ideal for local conditions. The long-term "Wiru" sorghums do not yield well in years of low and badly-distributed rainfall and imported varieties of short-term sorghums are not popular with local cultivators. In addition these short term sorghums generally store badly. Selection of suitable types from the white-grained sorghum grown in the Province might yield strains more suitable than either the long-term "Wiru" sorghums or the short-term imported varieties, and seed has been handed over to the Botanist at Ukiriguru for this purpose. One variety obtained from Northern Rhodesia also looks promising. A short-term variety imported by a local Mission from California, U.S.A., and grown at Mwanhala also has possibilities.

(c) *Millet.*—Finger millet *(Eleusine coracana)* is of importance only in Ufipa district and there it is being replaced gradually by maize. Exports from Ufipa are (in tons) :—

1948		*1949*		*1950*
434·4	...	27·4	...	96·6

Bulrush millet *(pennisetum typhoïdes)* is chiefly grown on the poorer soils of Nzega and Kahama districts. It forms a very small proportion of the total cereal crop.

(d) *Rice.*—The year was not a good one for rice growing since the crop did not fare well in the long dry spells and in the drier parts of the Province e.g. Tabora and Nzega districts the crop can only be described as a failure. The crop was good in Kahama and in the Lake shore area of Kigoma district but it is certain that far more could be achieved in rice production in the Province especially when full use is made of the rice dams constructed by staff of this Department. Sales of paddy in the produce markets were (in tons) :—

1947		*1948*		*1949*		*1950*
3,933·6	...	1,983·5	...	222·6	...	914·3

(e) *Beans.*—The crop was far less than expected. Preoccupation with the compulsory cassava planting campaign in Kibondo and Kasulu did much to reduce the area planted while the demand for the crop harvested was so great that much of it was bartered with goods brought over the border by natives from Urundi. A good crop was obtained in Ufipa; this crop is normally exported to Northern Rhodesia since transport costs to the Central Railway Line preclude its being marketed at an economic price. This year, however, beans were in such short supply that 11½ tons were moved from Ufipa to Central Line destinations. Sales were (in tons) :—

1947		*1948*		*1949*		*1950*
512·4	...	475·8	...	685·3	...	451·3

(f) *Other Legumes: Pigeon Pea.*—This crop is becoming much more popular especially in the western part of the Province (Kigoma, Kasulu and Kibondo). The scarcity of mixed beans meant that there was a brisk demand for pigeon pea and as the price paid to the grower (Cts. 50 per kilo) was generally twice the controlled price of mixed beans growers are keen to increase their plantings of pigeon pea.

Chick Pea (Cicer arietinum).—This has not yet caught on as has been the case in Lake Province. Seed has been distributed and the area planted is increasing. The crop is popular in Ufipa.

Cowpea and Green Gram. The amounts grown were negligible.

(g) *Groundnuts.*—The year was not a good one for groundnuts and it is doubtful if the crop will regain the prominence that it enjoyed in Western Province before the 1939-45 war. Sales in produce markets were (in tons) :—

1947		*1948*		*1949*		*1950*
3,933·6	...	2,465·8	...	235·5	...	473·1

(h) *Sunflower.*—The good prices offered to growers (often in excess of the controlled price of groundnuts) did much to popularise this crop and there has been a brisk demand for seed. The possibility of growing this crop in mixed cultivation with maize appeals to African cultivators while the ease of harvesting the crop compared to the laborious work of harvesting groundnuts is an added incentive. The crop has caught on especially in Kahama district but there has been increased planting in the Tabora area. Sales in the produce markets were (in tons) :—

1947		*1948*		*1949*		*1950*
75·4	...	170·4	...	233·5	...	630·3

(i) *Cassava.*—The value of cassava in Western Province has been amply demonstrated during the past few years since famine relief has had to be supplied only where cassava crops were insufficient for local requirements. In the past much of the cassava was planted towards the end of the main rains with the result that there was a big loss of plants during the first dry season. Early planting enables the cassava to become well established before the end of the main rains and since planting at the first onset of the rains does not interfere with other agricultural work it is being advocated wherever possible. Cassava can be planted as soon as the ground is soft enough to set up the usual ridges and this can be done often with the first few showers that fall before the rains have really set in.

In many parts of Tabora district wild pig do so much damage to cassava plots that it is a waste of time planting any other than bitter cassava. The "Liongo" variety of bitter cassava has been recommended now for some years and as a result there are extensive plantings of this variety. While not immune to pig (or rat) damage it is seldom that either of these ruins the crop entirely. Rats cause much damage to cassava in Mpanda and Ufipa districts but although the planting of bitter cassava has solved the problem of pig and rat damage in Tabora district, cultivators in Mpanda and Ufipa still insist that both kinds of cassava are attacked by rats to the same extent. The result is that there are periodic food shortages—especially in Mpanda district. This question of the susceptibility of Liongo cassava to rat damage in Mpanda is being investigated this year. Cassava scale has been reported from Tabora and Kahama districts this year but the outbreaks are not extensive. Burning of infected plants and the use of scale-free planting material is being recommended.

Sales of cassava root and cassava flour are highest in Kigoma from which district a considerable amount of cassava is exported. Plantings have been so extensive this (1950/51) planting season that there should be a considerable surplus from many districts. Sales in produce markets have been (in tons) :—

	1947	*1948*	*1949*	*1950*
Cassava root ...	1,034·8	4,768·0	1,870·2	1,174·1
Cassava Flour ...	—	1,674·2	510·0	576·9
Total ...	1,034·8	6,442·2	2,380·2	1,751·0

(j) *Tobacco.*—The growing of fire-cured tobacco in Kibondo district has proceeded apace since its inception in 1947 as the following figures show :—

Year	*Growers*	*Kilos sold*	*Paid to growers*
1947/48	277 ...	3,694 ...	Shs. 3,501/-
1948/49	1,105 ...	36,310 ...	Shs. 33,668/-
1949/50	2,827 ...	71,638 ...	Shs. 67,279/75

The Agricultural Assistant reports that the crop is popular mainly in the Kakonko area; there was not the same enthusiasm for it near to Kibondo itself due mainly to an outbreak of Red Rust in some of the best producing valleys in 1950 and also to the fact that the novelty of growing a new crop has now worn off. The crop is now firmly established as the most important cash crop in Kibondo.

(k) *Oil Palms.*—A count made in Kigoma district gave the following figures of oil palms :—

1-5 years old	67,612 palms
Over 5 years old	85,620 palms
Total ...	153,232 palms

Some progress was made in thinning oil palms, in weeding and clearing where overgrown and in pruning by removing dead leaves and leaf bases, but more attention to these points is still required if maximum output is to be obtained from existing palms. A fee of Shs. 2/- is payable for each palm cut down to make palm wine (malovu) and some 4,575 palms were cut down for this purpose in 1950—many of them palms which were no longer giving an economic return. The Red Palm Oil is extracted by growers in their own homes and sold by them for Shs. 1/50 per kilo at present. The kernels are sold in Produce Markets and so great has been the demand that prices paid to the producer have rocketed as the following figures show :—

January-July, 1950	Cts. –/29 per kilo
August, 1950	Cts. –/30 per kilo
September-December, 1950	Cts. –/66 per kilo
January, 1951	Shs. 1/20 per kilo

These high prices have been caused by forward contracts made by buyers and it is doubtful if they will be maintained. The amount of Palm Oil and Palm Kernels marketed in recent years has been (in tons) :—

	1947	*1948*	*1949*	*1950*
Red Palm Oil	34·4 ...	11·9 ...	26·0 ...	56·3
Palm Kernels	207·2 ...	263·6 ...	239·6 ...	224·5

At one time it was hoped to interest a large-scale enterprise in the planting of oil palms in Kigoma district but so far none has been willing to make more than preliminary enquiries in such a project.

(l) *Onions.*—After a somewhat slow start compared to other parts of the Territory the growing of onions has now become an extremely popular industry in Tabora district although there has been a big demand for seed in Nzega and Kahama districts. In all, some 437 lb. of onion seed have been sold to growers in 1950. Certain growers are using the water from Ussungu dam in Tabora district for both paddy cultivation and onion growing and provided the original purpose of the dam i.e. the provision of water for paddy growing is not interfered with the system is to be encouraged.

Attempts to produce onion seed were no more successful in 1950 than before largely on account of the absence of an Agricultural Assistant from Ufipa where the main trials were made. Arrangements have now been made to continue this work in 1951 on a non-native estate in Ufipa where irrigation is available and there is some good soil. In addition a small-scale planting has been made at Kibondo under the supervision of the Agricultural Assistant.

(m) *Vegetables.*—It is gratifying to record that interest in vegetable growing increases and that local vegetable growers have been able to supply fair quantities of vegetables for Tabora throughout the year. Many of them it must be admitted confine their activities to the growing of spinach but this phase is passing. Reference has already been made to the growing of onions as well as paddy in the area below Ussungu dam and it is hoped that this may lead to the growing of vegetables as well as paddy at other dams in the district.

(n) *Sisal.*—Four estates have been in production during the year. Production has been :—

1947		*1948*		*1949*		*1950*
1,047 tons	...	1,478 tons	...	1,345 tons	...	1,396 tons

(o) *Gum.*—Most of the gum sold in the Province is collected in Nzega District, although smaller amounts are obtained in Kahama. There was increasing interest in the grading of gum during the year and it is gratifying to record that the quality, quantity and value of the gum marketed constitute a record. Sales during recent years have been :—

1947		*1948*		*1949*		*1950*
244·5 tons	...	314·0 tons	...	273·6 tons	...	683·8 tons

Marketing

Produce markets in the eastern part of the Province, i.e. in Tabora, Nzega and Kahama districts, functioned reasonably well. In other parts of the Province, particularly Kasulu, Kibondo and Mpanda districts, produce markets are still too few for the efficient marketing of agricultural produce, and

arrangements are being made to increase the number of markets. In Kigoma, the produce markets worked smoothly. The amount of produce marketed is set out below :—

Product	*1949*	*1950*
Maize	848·1	3,433·0
Sorghum (mtama) ...	1,632·6	782·5
Millet (mawele)		375·1
Finger millet	27·4	96·6
Mixed grain	163·6	69·8
Paddy and rice	222·6	914·3
Groundnuts	235·5	473·1
Beans, mixed	685·3	451·3
Sunflower	233·5	630·3
Sesame	4·3	7·5
Cassava root	1,870·2	1,174·0
Cassava flour	510·0	576·9
Tobacco, fire-cured ...	36·5	71·6
Palm Oil	26·0	56·3
Palm kernels	239·6	224·5
Sisal	1,345·0	1,396·0
Gum	273·6	683·8
Beeswax	176·9	22·2
Honey	30·4	9·7
Wheat	64·7	12·9
Cowpeas (Kunde)	28·8	13·9
Chick pea (dengu) ...	25·2	16·0
Green gram (choroko) ...	3·0	9·5
Bambarra nut	5·9	12·7
Pigeon pea (mbaazi) ...	46·9	61·7

Pests and Diseases

Red Locusts (Nomadacris septemfasciata).—Swarms of adult locusts were present in the Rukwa Valley during the dry season, but staff of the International Red Locust Control Service reduced these swarms by dusting with DNOC. Several hatchings of hoppers took place in December, 1950, after the onset of the rains, but these were not extensive and were successfully dealt with by staff of the International Red Locust Control Service. There was no damage to cultivated crops.

Stalkborer (Busseola fusca) continues to do much damage to maize and sorghum crops. At one time it was thought possible to reduce stalkborer damage to negligible amounts in the eastern part of the Province by a thorough clean up of all maize and sorghum stalks during the long dry season, but this is not feasible since there are sufficient wild host plants of stalkborer to enable it to be carried over to the next crop season. Experiments to test the efficacy of insecticides in controlling stalkborer have been planned in conjunction with the Entomologist.

Mosaic is still common in cassava, although the loss of crop is not extremely high since certain varieties, e.g. "Liongo" produce quite good yields even if infected, and loss of crop is accentuated only when the infection is severe. The use of disease-free material for planting has kept infection reasonably low.

Cassava scale was reported for the first time in Western Province in 1950 but the outbreak was not serious. Advice to burn infected material and to use only scale-free material for planting has kept the outbreak under control.

Parasitic weeds.—Campaigns for the early destruction of *Striga* in maize and sorghum and *Alectra* in legumes have been kept up for several years and although both are still present the loss of crop caused by them is not unduly high.

Game and Vermin

The large areas of uncultivated land in Western Province provide excellent harbour for game and vermin and the damage done by these especially on the fringes of cultivated areas can be very high. Advice has already been given to plant cassava in adjacent plots if at all possible and to surround the entire area with a hedge or ditch or, better still, both. It is not always possible to plant all cassava in large blocks and for this reason, losses by game and vermin remain high. Bitter cassava is seldom attacked to the same extent as sweet varieties and since the planting of bitter cassava (variety "Liongo") has been advocated for several years there are now ample stocks of it in the province.

Rats have caused much damage to crops especially cassava in the Rukwa Valley of Mpanda and Ufipa districts and up to now have prevented cassava stocks being maintained at a satisfactory level as an insurance against food shortage through loss of annual crops. It is feared that no progress will be made in the extermination of rats until a poisoning campaign is instituted under the control of experienced staff and plans to this effect have already been made.

Soil and Water Conservation

The campaign for the tie-ridging of all cultivated land (except valley-bottomed and irrigated land) has been carried on in Western Province for several years. The results in the early years of the campaign were highly satisfactory but of late there has been much criticism of tie-ridging especially in Tabora district where some of the more vociferous cultivators contend that tie-ridging gives no increase over plain-ridging (the traditional system of cultivation in Unyamwezi) and also that it takes up too much time. A summary of results obtained from experimental plots in Western Province comparing tie-ridging with plain-ridging and flat cultivation has been prepared for circulation to Native Courts and at meetings of Chiefs, Headmen etc. Also, results obtained from Lake Province show that the extra time taken to "tie" a field already ridged amounts to only four man-days per acre. Tie-ridging undoubtedly is effective especially where the rainfall is obtained in a series of thunderstorms (as is often the case in Western Province) and it is a thoroughly practicable method of soil cultivation for the Eastern part of the Province (Tabora, Nzega and Kahama districts). Meantime, cultivators have been informed that the tie-ridging campaign must continue the Provincial Administration have endorsed this view and have given valuable support to the entire campaign.

Manuring of land is now firmly-established practice in those parts of the Province where stock are numerous (Tabora, Nzega and Kahama districts) although the amount of manure applied is often pitifully small.

Cultivators themselves appreciate the value of manure but have not yet reached the stage of placing crop residues in cattle bomas in sufficient quantity to increase the amount of manure made. A plan to store crop residues in fodder racks (matatalao) for feeding to cattle during the period end of dry season/beginning of rains is not yet a fully established practice.

In Ufipa district a manuring campaign was started by Mr. Yeo, Agricultural Assistant and it is unfortunate that much of the original progress achieved will have to be won over again since no relief was available on Mr. Yeo's departure on leave.

Dams for Rice Growing

The following dams were constructed during 1950 from allocations received from Development plan votes :—

Tabora District	*Capacity Gals.*
Sikonge	1,250,000
Utyatya	11,000,000
Kiloli	1,500,000
Tumbi	5,000,000
(Extension of the dam wall across the entire valley)	
Nzega District	*Gals.*
Itilima	1,000,000
Jomu	2,500,000
Itiro (1)	500,000
Itiro (2)	500,000

In addition, the wall of the Mwakuru dam constructed in 1949 was raised a further two feet to increase the capacity of the dam by a further 10,000,000 gallons to 50,000,000 gallons. A furrow was also constructed to carry the overflow of this dam into one of the Mwanhala farm dams.

Dams constructed from Native Treasury funds comprised :—

Kahama district	*Capacity Gals.*
Isagehe (1)	5,000,000
Isagehe (2)	3,000,000
Busangi	3,500,000
Kibondo district	
Bugunga (Kakonko)	5,000,000
(This dam has been constructed primarily for domestic water supplies).	

Better use is now being made of dams constructed for irrigation of paddy fields although certain stock owners still consider that these dams are primarily for the use of stock and it has been necessary to keep a careful watch to ensure that the original purpose of these dams is carried out.

Agricultural Stations

Tumbi.—The rains were poor and crop yields for the second year in succession were negligible. No European member of the Department was stationed at Tumbi during the year and it has been difficult to supervise

experimental work from Tabora. An encouraging feature has been the clearing of tsetse-infected bush nearby with the result that cattle can once more be kept and the manure made available for application to the land. Livestock at the end of the year comprised twenty-two cattle and thirty-eight goats; the goats were obtained originally during the period that cattle could not be kept on account of trypanosomiasis but now that this phase is over the goats are being disposed of.

Capital work during the year has been confined to extending the wall of the dam right across the valley so as to impound a far greater volume of water and make a larger area of land available for rice cultivation.

The Pasture Research Officer of the Veterinary Department who is engaged in opening up the newly-created Pasture Research Station has been stationed at Tumbi throughout the year. Assistance has been given him in the way of accommodation for himself, his staff and labour also the use of a tool-store and the loan of tools until his own supplies arrived.

Cultivation by tractor has been employed whenever possible and subsequent cultivation by oxen but even then there was difficulty in carrying out the planting programme at the proper time. This scarcity of labour at planting time is expected to become more acute in the future.

Multiplication of the pig-resistant "Liongo" cassava has been continued but supplies of this variety are now so good in Tabora district that demands for planting material can now be met locally.

Mwanhala.—The year has been one of much building activity. Two blocks of labour lines, a garage with two small stores and an extension to the Rest Camp have been built. Buildings to house the stock on the proposed Stock Farm which were started two years previously have now been completed. The heightening of the Mwakuru dam and the digging of a furrow to take the surplus water to the Mwanhala Farm dam has already been mentioned. Stock on the farm at the end of the year comprised a total of 24 work-oxen, 2 bulls, 28 cows, 10 bullocks and 7 heifers. A small stock of pigs (2 boars, 3 sows, 11 pig-lets) was kept. All stock were maintained in good condition.

Kahama.—The only capital work undertaken during the year was the construction of a new cowshed. Stock consisted of 29 work-oxen, 1 bull, 21 cows, 9 heifers and 5 bull calves. Work has been concentrated on the multiplication of seeds for distribution to African cultivators e.g. pigeon pea, bonavist bean and "Liongo" cassava. Two fodder racks (matanda) were constructed for demonstration purposes. Multiplication plots of paddy varieties were grown in the irrigated fields below the rice dam.

Sumbawanga.—Building work had to be held up on account of the lack of an Agricultural Assistant for the greater part of the year although repairs and re-thatching of the existing farm buildings were carried out. There is

no dipping tank on the farm and all cattle are hand-dressed weekly to remove ticks. All stock remained healthy in spite of the presence of East Coast Fever locally. Pure bred Rhode Island Red cockerels were maintained on the farm for crossing with the local pullets and supply of improved stock locally.

Experimental Work

Tumbi

Micro-plot manurial trial.—Three treatment rates (0, 1½ and 3 cwt. per acre) of N, P and K fertilisers. The trial was a failure on account of dry conditions.

Experiment 41.A. Residual effect of Sodaphosphate.—The plots were cropped with maize and later planted to cassava. Yield figures have been submitted to the East African Agricultural and Forestry Research Organisation.

Experiment 41.B. To test the effect of Sodaphosphate by itself and with other manures.—This has now been planted to cassava which will be harvested in 1951. It is a residual experiment.

Experiment 42. Sunflower.—To test the effect of removing axillary heads. The removal of axillary heads resulted in a higher yield of seed although the difference was not significant.

Experiment 44. Hungarian rice.—All varieties of Hungarian rice were inferior in yield to the two local varieties with which they were compared. This trial is now discontinued.

Experiment 45. Production of onion seed.—This trial was started in 1949 but is now discontinued since thrips attack has ruled out the possibility of obtaining worth-while yields.

Experiment 46. Mulching of cassava.—This is a continuation of the trial started in 1949. Damage by termites attacking via the grass mulch may rule out the possibility of mulching cassava fields. The plots will be harvested in 1951.

Experiment 47. Onion variety trial.—A repeat of the 1949 trial of four onion varieties ex U.S.A. Some of the seed was defective since two varieties showed no germination at all. The trial has been discontinued.

Experiment 48. Puddling of vegetable material in paddy fields.—This trial was a failure in 1950 owing to the early cessation of the rain.

Experiment 49. Tobacco variety trial.—At the request of the Senior Tobacco Officer a trial of three of the varieties of flue-cured tobacco commonly grown in the Iringa area was made. Varieties were Bonanza, Yellow Special, White Stem Orinoco. The season was far too dry for successful tobacco cultivation and this work is being adandoned since it is not proposed to introduce the growing of flue-cured tobacco at present.

Experiment 50. Cassava varieties.—Comparison of the mosaic-resistant cassavas *ex* Amani Institute with the standard local variety "Liongo" showed that they remained free of mosaic but were so badly attacked by rats and pig that yields were negligible. "Liongo" cassava although infected with mosaic still gave a reasonable yield.

Experiment 51. Cassava.—To test the effect of length of cuttings used for planting material. This experiment will be harvested in 1951.

Mwanhala

Experiment M.1. Fallows.—A crop of Wiru sorghum was planted as the third crop after the original fallow treatments which were applied in 1945-47. There was significant difference between the four treatment (Elephant grass, pigeon pea, cultivated fallow and control) although yields from plots planted originally to elephant grass were heaviest.

Experiment M.3. Ridging.—The experiment is designed to compare the effect of various sizes of ridge (3ft., 4ft. and 5ft.) with flat cultivation. The plots were planted to pennisetum in 1950: there were no significant differences between treatments.

Experiment M.5. Sunflower.—To test the effect of removing axillary heads of sunflower. There was no significant difference between treatments in 1950. This experiment has now been abandoned.

Experiment M.6.1. Manurial.—To compare the effect of 2 and 4 tons of shed manure with 2 and 4 tons of kraal manure and with control (no manure). The yields of Dobbs Sorghum obtained were highest for shed manure, followed by kraal manure and lowest of all for control. The differences were not statistically significant on account of the great variation between blocks.

Experiment 7. Rice.—To test the value of several puddle mulches in rice fields. Only two blocks of the six planted were harvested on account of lack of adequate irrigation water.

American sorghums.—Fifteen varieties of quick-maturing sorghums ex the United States of America were planted for the second year but were a complete failure.

LUICHE VALLEY RECLAMATION

Work on the canalisation of the Luiche river to drain the fertile Luiche swamp and make available for cultivation the entire Luiche swamp area of fourteen square miles was continued during the year. This work was started in 1949 by means of funds put up by the Kigoma Native Treasury. Native Treasury allocations totalled £1,118 in 1949, £1,100 in 1950 and a further £1,272 has been voted to complete the work in 1951. A contribution of £1,500 was made for this work in 1950 from Development and Welfare Plan votes. The river channel is now cut over the whole distance although at one

point the width of the channel is only 12ft. instead of the full width of 24ft. and as a consequence part of the river water is still following the old winding river bed. Work will be resumed in June, 1951, when the new channel will be widened to the full width of 24ft. for the remaining 400 yards and the old river bed will be blocked. Much credit goes to Mr. Shepstone, Agricultural Assistant, for the work accomplished on this scheme in 1949 and 1950.

Acknowledgment

I wish to express my appreciation of the work of both European and African staff during the year. The Provincial Administration have given valuable aid in matters pertaining to agriculture and without such aid it would have been impossible to accomplish what has been done.

J. K. Robertson,
Provincial Agricultural Officer,
Western Province

LAKE PROVINCE

Staff in General

It is gratifying to report that each district in the Province is now staffed with at least one officer. The total supervising staff including African staff in charge of districts in the Province number thirty-one of whom eighteen are engaged on extension work and thirteen are engaged on special duties. Eleven extension officers are paid from Provincial Council, and seven from Lake Province Cotton Committee funds. The remainder are paid by Central Government. The Committee still awaits the arrival of seven more Agricultural Assistants to make up its complement. As regards African Staff, owing to the additional personnel provided by the Lake Province Cotton Committee, in certain districts it is now possible to allocate one Instructor to every four hundred taxpayers. This is the stage at which the Instructor can become a teacher in the real sense.

Visitors

His Excellency the Governor visited the Province in February and October. The honourable the Member for Agriculture and Natural Resources, the honourable the Director of Agriculture and the Deputy Director of Agriculture also visited the Province during the year. Other visitors were the Assistant Director of Education (Africa), Professor McMillan, Mr. John Dugdale, Minister of State for the Colonies, Mr. J. C. May, Director of the Empire Cotton Growing Corporation, Mr. John of the Colonial Development Corporation, Mr. Griffin-Smith, Coffee Representative in London for the Coffee Boards of Kenya, Uganda and Tanganyika, a representative of the East African Tobacco Company, Kampala, with two Belgian Congo Officers, the District Commissioner, Masaka, with two Chiefs, and the Members of the Brazilian Mission, Messrs. Paiva and Mendes.

General

A very good season has been experienced, which was needed to compensate us for the season of 1949, one of the worst seasons in the experience of the Wasukuma during this century. In Sukuma particularly, grain crops were very heavy, so much so that in certain areas great difficulty has been experienced in harvesting the crops and taking them to the houses. It will be seen from Annexure No. 1 that there is an estimated increase of 8,321 tons in the volume of produce sold by the producer worth some £781,547. This increase of cash in the hands of the producer, which it is hoped will be a permanent feature in the future, justifies considerable thought as to the best purposes to which this extra cash should be put. The Department is investigating the possibilities of the greater use of Agricultural hand-implements, ox-drawn implements, and tractors and tractor-drawn implements, and the wheel in general, with a view to part of this surplus being absorbed back into the industry, which has now got to the stage where it cannot really advance without some capital expenditure by the individual cultivator.

The system of having one Agricultural Officer to inspect the work in the districts of East Lake has proved very satisfactory, and the Agricultural Officer, Bukoba, now gives technical advice to the Ngara District as well as his own.

Whilst the decline in production mentioned in the previous report has steadied with a marketed tonnage similar to that in 1947 and 1948, the production of Sukuma is still in the trough into which it fell from 1945 onwards. There has, however, been a gratifying increase in the production of chickpea and although little grain has gone on to the market, the food position is of course very satisfactory indeed.

Bukoba unfortunately continued to suffer from periods of drought, which severely reduced the surpluses of foodstuffs for sale and in some cases gave anxiety as to the food position.

Weather in Relation to Crops

1950 was on the whole an excellent season. In Biharamulo the rains began late, but ended up satisfactorily. In Bukoba drought alternated with deluge, which caused annual crops to suffer and reduced banana production to an even lower ebb, particularly in the west and south. In Musoma and North Mara the good early rains allowed large acreages to be put under crop. The planting rains in Sukuma were almost perfect though the growing rains at the end of the season were excessive and resulted in severe pest incidence on cotton.

Legislation

It is gratifying to record that the Sukuma Livestock Restriction and Land Settlement Rules were approved by Government, albeit with the withdrawal of the clause enabling trespassers to be evicted. Sanction was given to Native Authorities under the Native Authority Ordinance to control the

cutting or sale of Hedge Sisal. The Cotton Ordinance was amended to deal with certain matters in respect of undermeasure weights and to tighten up the section regarding the production of cotton lint by ginners, in order to make for more efficient ginning.

Cotton and Food Production Scheme

No progress was made in setting up the suggested Lake Province Cotton Board, but the scheme continued to progress under the guidance of the Lake Province Cotton Committee, with funds provided from an advance from Government. Whilst 130 African Instructors were recruited towards the end of 1949, they were not able to affect the production of the 1950 cotton crop. The European Staff began to arrive in March, and whilst 270 more African Staff were recruited and given short courses of training, it is doubtful whether any of this staff will have had any real effect on the production during 1950/51.

It has only been possible to concentrate European and African staff in the two districts of Kwimba and Mwanza, in the concentration which is considered desirable to practise the policy of "closer". Experience in these two districts indicates that with such a large staff of Africans, new supervisory methods must be adopted which are now in the trial stage. There is no doubt as to the progress which can be made when an officer is able to concentrate on a fraction of the population to which it has been the custom to post an officer in the past. The chiefdoms of Bukumbi and Buregeia totalling 4,733 taxpayers have now been supervised by an Agricultural Assistant for two years, and the new agricultural practices are undoubtedly taking root.

The two experimental mechanical units began their work in May and by the end of the year sufficient accurate costings had been obtained to start 1951 on an economical basis. An immense amount of knowledge of the problem of adapting tractors and implements to the difficult Sukuma soils was obtained. Whilst the problem of integrating mechanisation into the life of the cultivator has barely been touched, the schemes can approach this problem with some sound factual knowledge of their mechanical limitations. The tractors and implements required for the different operations and soils are now known and additional equipment is being ordered to make each of the two schemes into an economical unit.

The Secretary of the Lake Province Cotton Committee undertook all the routine organising of building up the staff and equipment and housing them. A Building Foreman was employed from April, who completed two quarters, one office block, one store and reconstructed another building as a tractor station. Three other quarters were completed by the staff who were to occupy them. A start was made in equipping the tractor workshop at Fulo, near Ukiriguru, which together with stocks of spares and fuel, is in the hands of an Agricultural Assistant with considerable mechanical experience.

Publications

Numerous newly-published local newspapers have assisted in putting agricultural matters before the people. About 3,000 copies of *Mambo Ya Ukulima* have, I understand, been distributed or sold from departmental stocks. The Education Officer, Ukiriguru, is in process of re-writing all the lectures for the training centre, eight of which have been cyclostyled and bound in book form.

Estate Agriculture

Four hundred and fifty-four tons of sisal fibre were produced from estates, much of this being from purchased leaf. Seventy acres of sugar cane were established on the pilot sugar estate in the Bukoba district and a jagree plant is in process of erection.

Details from the Districts

(a) *Food Crops.*—Cultivators energetically applied themselves to the production of large quantities of food, as a result of the severe famine conditions which prevailed in 1949. The dry planting began in Sukuma as early as September and the excellent season resulted in bumper food crops, with the exception of the Bukoba district. The continuing deterioration in the yield of bananas in the Bukoba district is causing concern, particularly as the women are disinclined to raise supplementary foodstuffs to meet shortfall in bananas. The fall in yield is ascribed in part to the shortage of manure and to general neglect and also to the cutting of the fruits before they are fully mature and to the spread of the coffee root system. It was unfortunately not possible to take advantage of this enthusiasm for cultivation to increase the acreage of cassava as much as we would have liked, owing to shortage of planting material, much of which in any case was infected with cassava scale.

(b) *Cash Crops.*—Tobacco sold to the Nyamirembe Native Tobacco Board showed an increase of 52 tons over last year, to which Biharamulo district itself contributed 86 tons of the total of 183 tons. The Kibondo district is annually increasing its production, whilst the Busubi chiefdom of the Ngara district finds difficulty in maintaining interest. The spraying against Antestia is undoubtedly responsible for a considerable portion of the increase in the Arabica coffee crop in Bugufi, which rose from 70 tons in 1949 to 220 tons in 1950. There is a little more enthusiasm for this crop as a result of increased payments by the Ministry of Food. Bukoba exported 8,045 tons of coffee. The new contract with the Ministry of Food enabled the prices to be increased: -

"There has been no appreciable improvement in the cultural work of the coffee despite the helpful contribution of additional field staff by the Bukoba Native Coffee Board. It had been anticipated that increased prices would have stimulated greater interest in the care of coffee, but the response to instruction and demonstration has been most disappointing. Mulching has now been definitely adopted, but pressure is still necessary."

An all time record in the production of beans was set during torrential rains in March following a very dry spell of weather. Despite this 1,500 tons were produced for export.

In Ukerewe a small coffee industry of over 1,000 growers was discovered. The average number of trees per grower is 80, mostly of Arabica. The North Mara district made its usual contribution of maize to the Musoma Mines with a proportion for export to other parts of the territory. The crop was excellent amounting to 4,185 tons.

The "mushroom" hedge sisal industry is having a profound effect on the economy of the eastern districts of the province. About seven thousand tons were produced of an approximate value of £450,000 to the producer. The decortication of sisal leaves by hand in primitive decorticators in a large percentage of the homesteads of the districts of North Mara, Musoma, Kwimba and Mwanza was bound to affect deleteriously the attention paid to crops. One man can produce in one day as much Shs. 10/- worth of fibre from countless sisal plants. The Native Authorities instituted a closed season to enable crops to be harvested and to obviate seed cotton being mixed with sisal fibre in the homesteads. The cutting and sale of fibre was allowed for varying periods of six weeks to two months from the end of August. Even this limited open period seriously affected dry planting for the 1950/51 season and owing to a large illicit trade by traders in the close season, crop cultivation was being seriously interfered with right up to the end of the year.

The cotton season was disappointing in that the average planted could have produced 50,000 bales, instead of 39,000 bales, had the weather been propitious. Insect damage, particularly American Boll Worm, was the chief factor. Sukuma was responsible for 24,000 bales, but comparing the production in five year running averages with that of 1948 of 32,000 bales, the 1950 figures of 25,000 bales leaves much to be desired. The districts of Musoma and Ukerewe are holding the province's cotton production at its present level in spite of the fall in production from Sukuma. After investigation of the conditions in South Geita district, it was decided that cotton was unsuitable for that area and seed was, therefore, withheld. The chickpea crop amounting to 4,970 tons has reduced cotton in many of the "Mbuga" areas. It is unfortunate that the production of this crop is certain to suffer from erratic prices, as it fits very well into the rotation. The paddy crop was an improvement on previous years at 5,500 tons, to which the Kwimba district was a strong contributor. The 547 tons of gum produced in the Shinyanga district was a useful additional contribution to the cash of that area in compensation for a poor cotton crop. 622 tons of gum in all were marketed in the provinces.

(c) *Food Storage*.—Whilst the plant for storing 10,000 tons of food has been approved by all concerned and funds earmarked for this purpose, little progress has been made as plans from the Department of Grain Storage have been awaited. Local opinion now favours the storage of the grain at strategic points rather that in scattered silos all over the country.

(d) *Improvement of Seed Supplies.*—5,000 tons of U.K. 46 Cotton seed sufficed for distribution to all cotton districts. Unfortunately the labour shortage reduced output from the ginneries and seed could not be got to the Shinyanga district in time. M.Z. 561 was, therefore, again planted in that area. The cultivator has been taught to economise in seed, with some success. 235 tons of U.K. 48 seed were distributed to the selected areas round the Buchenzi Ginnery. The difference in the ginning percentage of U.K. 46 as compared with M.Z. 561, is one per cent. This comparison is derived from the ginning tests made at comparable ginneries growing the two strains. This increase in the production of lint is equivalent to £35,000 in terms of value of seed cotton paid to the producer. 900 lb. of Heavy Western Tobacco seed and five tons of maize seed were produced from the Biharamulo Tobacco Board's Farm. Some of this tobacco seed was distributed in the Geita district, where the coil trade in native tobacco is important. Cultivators would only plant this improved seed on the assurance that they were not to be made to fire-cure. Supplies of planting material of a mosaic-resistant strain of cassava bred in Urundi were planted in the Ngara district. Little progress was made with the multiplication of our own mosaic-resistant strains, owing to the treatment against cassava scale being unsatisfactory. Many of the plots had to be uprooted. Considerable acreages of two indigenous strains of cassava which produce heavy yields of roots on heavy soils have been planted, particularly along the river system. These strains are worth a trial in other parts of the territory. A great variety of seed has been distributed in Ngara district by the D.C. and Agricultural Assistant comprising maize, paddy, onions, papaws and chillies.

(e) *Improvement of Farming Systems and Agriculture* :—In the Ngara district multiple stem pruning of coffee has been in the large scale trial stage for some years now. It is undoubtedly the right system and a start has been made by converting 20,000 trees. In the past too little interest has been displayed in grazing reserves, but the work of defining land usage areas has shown the need to rationalise the definition and maintenance of these reserves, which are indigenous to Sukuma.

(f) *Soil Conservation and Soil Fertility.*—"The Department's efforts in conserving the soil are mostly directed to the introduction of tie-ridging to all cultivators who habitually plant on the ridge, and the five-yard strip of grass to those who normally cultivate on the flat or with a plough. Progress in both these respects has been good, particularly in the Musoma district. Another measure, the conservation of stubbles of harvested crops until late in the dry season, has been very successful, and officers have noted a reduction in wind-erosion as a result. Manuring of the land needs little recommendation to the average Sukuma cultivator, and the transport difficulty is really the controlling factor. The use of wheelbarrows is being encouraged, and successful experiments have been conducted in transporting manure by tractor and trailer at a rate of Shs. 7/- per trip. When it is realised that an application of only six tons of farmyard manure per acre may benefit the

crop as much as 40 per cent increase in yield without further application, even in the sixth year, the importance of persuading the African cultivator to fertilize his land can be fully appreciated."

Contour ridging and hedging continues in Ngara. A native Authority rule has been promulgated in Biharamulo enforcing the use of ridges and also of re-ridging, wherever feasible. The production of manure for both bananas and coffee is of great importance in Bukoba and the loss of 1,000 head through Rinderpest out of a total of 27,000 head in the coffee areas is a further step in the decline of the stock industry on which their agriculture to a great extent depends. Plans for reviving this industry are in train. In North Mara some progress is being made with ridging and re-ridging, and manuring. In Usetewe the Native Authority have ruled that all fields shall be re-ridged in 1951 and the prospects of this being fulfilled are very good. There has been real progress in soil conservation in the Geita district since the arrival of the District Commissioner and Agricultural Assistant. Two pilot areas were selected in the Kwimba district where contour banking was demonstrated and all other useful soil conservation measures applied. In Maswa slow progress is being made with grass strips on sloping lands which are difficult to ridge. Wherever there was concentration of staff an improvement in the adoption of new practices was noticeable. The collection of straw for bedding down stock, thus increasing manure, was carried out better than ever before. The loss of manure due to the death of 600,000 head of cattle in Sukuma will take some time to make up by increasing the production of manure through the use of straw.

(g) *Eradication of Weeds.*—No progress has been made with investigations on the control of the two coarse grasses which have invaded pasture lands in North Mara. This experiment is definitely being laid down in 1951. As regards the Opuntia menace the Entomologists are unable to supply an economic solution.

(h) *Water Conservation.*—About thirty-five water supplies have been dug in the Province, five of which have been excavated by machinery and six have been dug by hand under the supervision of Officers of this Department. The Sukumaland Development team have adapted three dams so that rice may be irrigated below them. In Kwimba instructors have been provided with striding levels to level the bounds. As has been reported from other parts of the territory, cultivators are shy at taking up rice lands below these dams for the first few years.

(i) *Land Utilization Planning.*—Visits have been paid by the Natural Resources Committee of the Provincial Council to Biharamulo, Ngara, Bukoba, Geita, Musoma and North Mara districts. In each case programmes of development have been discussed, and recommendations made to Government in the case of the West Lake districts. The system of District Teams has begun to work better, and all districts in East Lake and Sukuma now hold regular meetings. Of special importance has been the work of defining land usage areas in Sukumaland. The Land Settlement and Stock Restric-

tion Rules of Sukuma rely on the establishment of Councils for each land usage area to determine the densities of humans and stock, and the numbers which should be let in. In collaboration with the Veterinary Department this work of definition was almost completed by the end of the year. Most valuable information has been obtained, at the same time, on the movements of stock and availability of water supplies. In order to provide facts and figures so necessary in over-all planning, the Crop Yield Survey of Sukumaland and Ukerewe has again been repeated. Both European and African Staff have spent much of their time on both this survey and the survey of acreage of all crops for the World Agricultural Census. The latter is being conducted in the Sukuma districts, Ukerewe and Bukoba.

(j) *Expansion Areas.*—Only another 100 families settled in the new areas opened up in Majita to accommodate people from the overcrowded peninsula. The block system of controlled settlement continues. An Agricultural Officer made a report on the area at the end of the year. It appears that the movement of 6,000 people has only balanced off the increase due to births, for there is no spare land to be seen in the peninsula. No progress was made with the plan for the development of the hinterland areas of Bukoba district. The Geita district provides the largest expansion area for the Wasukuma and the Sukumaland Development Team have concentrated their effort there. The outbreak of sleeping sickness and the habit of sporadic settlement necessitated a line being drawn from north to south, where settlement was thinnest, beyond which settlement would be forbidden. As usual, after a good year, migration has been on a small scale. Although a plan of development for the Ukerewe mainland was designed to accommodate Wakerewe from their overcrowded lands, it appears inevitable that other tribes will benefit by this scheme. Good cotton crops make this area popular. Only 250 people have moved into the old Tsetse Experiment Block No. 11 in Shinyanga.

(k) *Development of Sukumaland.*—1950 saw the completion of the Malya Station, the Headquarters for the development of Sukumaland. Three Agricultural Assistants were seconded to Sukumaland Development Team. At last two tractors were provided with sufficient ancillary equipment to begin excavation of water supplies in the Geita District; it is far too small a unit for the magnitude of the scheme. The provision of water supplies in the Geita district necessitates the use of machinery due to the absence of population in the new area. The team drew up a revised policy. They are finding it more and more necessary to limit rehabilitation in pilot areas owing to the overwhelming needs of general development and resettlement. Towards the end of the year an Agricultural Assistant was posted to survey in detail the 100 square mile land usage area at Ibindo, Kwimba District, in order to assist in the laying down of an agricultural pattern. Two quarter-acre fish ponds were excavated, to be irrigated from the dam, and an African overseer, who completed a Fishery Course at Korogwe, was posted to Malya to interest Native Authorities from there. There was a great improvement in the co-

ordination of the work of the Development Team with that of the district teams during the year. At many District Team meetings a representative of the Development Team was present. Great assistance has been given by the team in sorting out problems connected with extension and development at District Team level to the great advantage of the officers of this department.

(l) *Training of Agricultural Instructors.*—The new buildings of the Agricultural Training Centre were opened by the Honourable Member for Agriculture and Natural Resources, Mr. J. C. Muir, C.M.G., O.B.E., on the 3rd March. An Agricultural Assistant with both agricultural and teaching training was posted to the Centre in June. This has enabled the Headmaster to provide numerous short courses for newly appointed instructors of the Lake Province Cotton Committee. He has also been able to perfect his system of practical work to be done in school gardens of the different standards, providing field plans for each. The building programme undertaken by the Headmaster was not inconsiderable. The three temporary European quarters were completed, and other buildings erected included a tobacco wilting shed and curing barn, a poultry unit, cattle shed and outbuildings for the teachers' quarters. Practical work has formed a greater proportion of the curriculum than in the past, embodying work with stock as well as on the fields, and much of the building of the outhouses and improvement of the site was undertaken by the students. The students are divided into higher and lower classes, in order to obviate the students of Standards 8 to 10 being held back by their less educated comrades. The Headmaster completed booklets incorporating the revised lectures on six subjects. It is intended to publish all the Ukiriguru lectures in this form. To replace the old laborious system of note taking each student is issued with a copy. It has become customary to allocate some vacancies to teachers from the Missions and Education Department, whom it is desired to post to schools to give a certain rural bias and to supervise the school gardens. In October their numbers were inordinately increased from 12 to 23. Demonstration School gardens have now been laid out for the specialised work of this group. Two short courses for school supervisors and headmasters were held to explain the school garden system. Course 10 comprises 60 students and Course 11, which began in October, comprises 70 students of whom 11 are teachers. The Agricultural Training Centre has gone through many vicissitudes both in connection with buildings, staff and students, and the improvement of the two former appears to have given confidence to the latter and I cannot do better than quote the Headmaster himself in this respect:—

"We can approach the new year with greater confidence than ever before, for, with the new facilities fully available and a willing conscientious staff, there is every prospect of making the best of the greatly improved type of student now coming forward. The changing attitude of students, whether spontaneous or induced by our system here is the most outstanding thing of 1950, and in a country where native ideas seem to be tending more and more away from realism this practical outlook is most encouraging".

(m) *Pests and Diseases.*—The Kagera Dwarf Locust swarms spasmodically in the West Lake Districts, but has so far done little damage. 150,000 coffee trees were treated against White Borer in the Bukoba District, but the lethargy of the grower will always, it is feared, prevent eradication, for he only treats his trees when pressed. It looks as though white scale on cassava has come to stay and that we shall have to grow cassava in spite of it. Its incidence is up and down. So far all attempts to treat cuttings against it have proved unsuccessful. The worst districts for infestation are Ukerewe and Mwanza. The Agricultural Assistant, Kwimba, continued with his porcupine poisoning campaign with great success. Great damage was done to the cotton crop by American Boll Worm which, probably accounted for the loss of as much as 10,000 bales. The best method of control of this pest is to delay the planting of maize until February. This is unpopular with cultivators but has been tried in the Mwanza District during the 1950/51 season.

(n) *Demonstration.*—The demonstration plots in Bukoba, mentioned in the last report, have not met with any success. It is not so much that the plot-holders are unenthusiastic or incapable as that they fear to carry out the work well in case of reprisals. The system of distributing prizes to selected cultivators is replacing district plots. In some districts wheelbarrows have been issued as prizes. In the Maswa District in particular it is thought the giving of rewards is an incentive and prizes are distributed with some ceremony before large meetings of cultivators when opportunity is taken to harangue them on agricultural matters.

(o) *Experimentation.*—Trials of wheat were not very successful in either the Biharamulo or Ngara Districts. The Maruku Coffee Station in Bukoba was nearing completion at the end of the year. The banana establishment trial was planted. The treatments included various combinations of artificial and organic fertilizers to form the N.P.K. experiment. The plots were divided in half to compare the ability of bull suckers and ordinary suckers to establish themselves. Kudzu Vine may prove efficacious as a cover crop to keep out couch. Once established it grows very well in Bukoba and seeds readily. The Agricultural Officer, Bukoba, gathered as much planting material together as he could in the form of bananas, hedges and grasses, planting them on the different soils in order to give a basis for the work of the newly-appointed officer. Bananas failed to establish themselves on the poor pasture soil, but a few creeping grasses survived. It is even difficult to establish an Erythrina hedge on these poor soils. Seven acres of *Cenchrus ciliaris* grass were established at Ngudu in the Kwimba District to provide seed for future grass stripping, and establishment of pasture.

The Lubaga Experimental Station and Seed Farm was managed by the Agricultural Assistant, Shinyanga, in addition to his district duties. The Nyamahona Station was kept on a purely maintenance basis but serves as a centre for training of oxen and of ploughing teams for hire. The Native Treasury Seed Farm in North Mara was maintained. The Native Treasury Farm at Ngwamapalala in the Maswa District was laid out anew by the African Agricultural Assistant in contour strips, and produced good crops.

(p) *Propaganda and Contact with the Peasant.*—The Department is pinning its hopes on the effect of "chivvy" on the peasant, as a result of the strengthening of the African Staff in certain Chiefdoms and Districts. An Instructor with 400 taxpayers to supervise, living in probably 250 huts, should be able to make contact with every hut at least four times a year. If he is a good Instructor and his teachings have conviction, there should be some material results in a year or two, for at least we know that what he is teaching will not fail to produce good results once put into practice.

These new recruits require a lot of initial training and weeding out. Such a large staff requires new methods of supervision and forms have been devised to bring this about. A check can be made on the whereabouts of Instructors by requiring them to sign the daily diaries of the Senior Instructors and *vice versa*. Individual Cultivators' Record Forms have been issued on which are marked all the important crops and operations so that suitable symbols against each cultivator's name can indicate the progress made with such crops and operations. These records not only enable quick checks to be made of the state of affairs in any particular village, but also require the Instructor to make an endeavour to visit all the fields and the figures can form a basis for estimates of crop production. In most districts a few areas have been selected for special concentrated attention, in advance of the rest of the countryside. This has led to good results.

The mass literacy classes in Ukerewe almost died of inanition, but may revive with the posting of an African Social Development Officer.

(q) *Grading and Marketing.*—The new tobacco factory was opened by His Excellency the Governor at Biharamulo early in the year.

The Agricultural Assistant in charge of coffee grading at Bukoba also undertook the inspection of beans and soya beans. Early in the year the Grain Storage Department appointed the African Mercantile Company to undertake the grading of beans.

Thirty-two primary Co-operative Societies for the collection of coffee and a Co-operative Union were registered in Bukoba. Membership of these societies is increasing fast and is estimated to exceed sixty per cent of all coffee growers. The first payment to growers had to be kept in line with the Ministry of Food contract price, as it was always possible—though admittedly improbable—that the balance of the crop sold on the free market might be sold for less than the Ministry's price. Members of Co-operative Societies, however, received the full value for the crop in second and third payments, derived from the sale of free market coffees at variable prices, whereas it was not possible to pay these sums to non-co-operative members as their names and the quantities they sold were not known. This disparity in price has naturally encouraged membership of societies, somewhat embarrassing the Co-operative Officer. It has also resulted in some smuggling over the border to Uganda and coffee dealers, who are also co-operative members, have made good business in selling their customers' crops as their own and acquiring second and third payments on them.

The Bukoba Native Coffee Board has worked under difficulties owing to the absence of an Executive Officer for six months of the year. The first of the district hulleries was completed. A number of others are in various stages of completion.

Cotton marketing proceeded smoothly on the whole. Special clerks were posted to the bigger markets to supervise sorting into the two grades to ensure the elimination of all sisal fibre in the parcels of seed cotton brought to the markets. As a result, the quality of the crop as regards stain was better than for some years. The system of independent weighers worked smoothly where their scales were correct. Unfortunately even new spring scales soon became faulty. The Murutunguru Ginnery was taken over by the Ukerewe Cotton Company Limited, who inaugurated a system of issuing receipts to sellers, which proved popular. Whilst a suitable design of platform scale was devised by Messrs. Avery, the ginners were not willing to purchase them in large numbers until trials had been made.

(r) *Implements.*—Messrs. Ransomes, Sims and Jefferies supplied a prototype Ridger to our design, but after further test it has been modified to a more unconventional design, but one which will put up a four feet ridge satisfactory to the African cultivator. Ten copies of this will be issued to cultivators for tests under their conditions and on different soils. Ten to twelve draft oxen are required, which will necessitate the loaning of teams to make up the required number.

The plough cannot be used on the light soils of Sukuma until it can put up a ridge. This is a serious limiting factor to agricultural development and the provision of a suitable ridging plough is extremely important. A suitable tractor drawn ridging implement composed of six or eight discs on a fixed tool bar, has made very fine five feet ridges at Ukiriguru.

Very few ox-ploughs were sold during the year. The use of wheeled equipment is absolutely fundamental to progress, and whilst another few hundred wheelbarrow wheels were sold, or distributed as prizes, the wheel will make very little impression on agriculture until it is available for sale in every shop in the Province.

(s) *Crop Surveys.*—The world census of agriculture in respect of acreage and crop yield was almost complete by the end of the year. So soon as the results are tabulated there will be an interesting comparison between the acreages of 1945 and 1950 and the yields of 1949 and 1950. The census has been an arduous task which has occupied much of the time of the Officers in charge of districts and their staffs.

(t) *Ginneries.*—The Ginnery Inspector instituted pre-licensing ginning tests at each ginnery. Licences were not issued until the machinery was reported as being in order. This system was most effective and will be continued. Standard bale ginning tests were carried out at all ginneries, except Pambani. Ginning standards were better than in 1949, and the Buchosa Ginnery, which had an unfortunate lapse last year, has produced lint of very high standard. Transportation of lint and seed gave anxiety as storage for the former and

ginneries for the latter were inadequate. The Mwanza Cotton Trading Company are moving their ginnery to Ukerewe Mainland. The Nakasero Commercial Corporation are planning to move their ginnery to the Geita District.

The Ginnery Inspector set up the air-blast saw gin at Ihale Ginnery. The cotton technician of the Lint Marketing Board, Uganda, kindly assisted us in checking the quality of the lint initially turned out from the gin. Seed cotton, equivalent to ten bales of lint, was collected at random from various buying posts in each zone in order to produce saw gin samples for export by the trade.

Labour in the ginneries is becoming increasingly scarce, and the ginneries appreciate the need for labour-saving devices. Most of the permanent Ginnery Buying Posts were provided with corrugated iron buildings. Very little cotton was stored in the open and there were no reports of damage by rain.

(u) *Miscellaneous.*—The Regional Assistant Director of Agriculture acted as Executive Officer of the Lake Province Cotton Committee throughout the year and sat on the following Boards :—

1. The Bukoba Native Coffee Board.
2. The Nyamirembe Native Tobacco Board.
3. The Lake Victoria Fisheries Board.
4. Four Meetings of the Lake Province Council were attended.

CONCLUSION

This is the seventh consecutive annual report the writer has submitted on the agriculture of the Lake Province. This is a long enough period in which to note even the customary slow progress of conservative agriculturists. There has been a retrogression in the production of groundnuts and rice. Cotton and coffee have only stood their ground. Whilst other crops such as cassava, seed, grain and pulses have come more into the picture, crop production on the whole has been disappointing. This failure to increase production is partly due to the steadily rising prices of primary products paid throughout this period. The shortage of consumer goods and their poor variety is also partly responsible.

Progress in agriculture can best be demonstrated by the appearance of the countryside, the standard of living of the people and the volume of freight on the railway. In all respects there is visible evidence of improvement, perhaps least in the latter respect. The highlights of this period have been the organization of the marketing of the main crops, including producers' co-operatives; the establishment of a central organization to develop Sukuma; the erection and equipping of the experimental station at Ukiriguru; the inception of the Lake Province Cotton Committee and its staff and mechanical equipment. West Lake has lagged behind in development, but the establishment and staffing of the Maruku Coffee Station is in anticipation of a quickening of effort in this direction. The Bukoba Native Coffee Board has made big strides in reorganizing the coffee industry and the processing of the crop.

The efforts of Government in developing the land are now set in a framework of teams and consultation and co-operation, so unlike the individual independent departmental efforts of the past. A vast amount of factual information has been collected and planning is now possible on sound lines.

The demand for additional staff, both African and European is now being realised and once they have had some training and experience, and once the latter have settled down and learnt the language, then greater progress in better farming and increased production should result. This result cannot be achieved by direction from an office. Our demonstrators must get near to the people and the gap between both the Native Authorities and the Government and the people must be bridged. It is expected that the Parish, Chiefdom and Land Usage Area Councils will greatly help in this respect in Sukuma.

The progress which district teams have made in the co-ordination of effort and planning is an earnest of the willingness of all officers to pool experience and resources at district level, which does not need acknowledgment from each and every department. The team of officers at Ukiriguru, including those of the Empire Cotton Growing Corporation, have contributed much to our progress. Better farming and with it the improvement of the standard of living of the African continue to be the watchword of this Department.

N. V. Rounce,
Regional Assistant Director of Agriculture

MARKET RETURNS, LAKE PROVINCE 1949 AND 1950 *Annexure I*

CROP	1949		1950	
	Quantity Purchased in Tons	Value to Producer in £	Quantity Purchased in Tons	Value to Producer in £
Paddy	1,996	17,156	5,155	85,201
Chickpea	3,784	92,610	4,403	98,369
Simsim	27	333	12	217
Gum	272	7,596	614	24,218
Greams	2,691	24,533	5,332	87,558
Sunflower	243	5,387	107	2,161
Other Legumes	—	—	7	191
Cowpea	459	4,593	13	323
Groundnuts	15	146	296	6,995
Cassava	256	3,072	30	269
Coffee, Arabica	2,087	103,306	8,045	679,769
Coffee, Robusta	5,200	228,800		
Mixed Beans*	2,004	36,082	1,810	4,108
Soya Beans*	988	21,125	832	20,280
Potatoes*	227	1,930	173	1,686
Citrus*	233	3,672	290	1,948
Other Fruits*	—	—	157	1,065
Vegetables*			10	224
Onions*	144	4,320	148	3,552
Tobacco	140	4,961	111	5,858
Cotton Lint	22,022	575,044	6,964	581,399
Cotton Seed			10,000	
Sisal (estimated)	430	3,000	7,000	450,000
Total ...	43,218	1,137,666	51,509	2,055,391

*Export value at Bukoba

SOUTHERN HIGHLANDS PROVINCE

Weather

Climatic conditions in 1950 were more favourable to crop production following the exceptionally dry season of 1949. In Mbeya and Chunya districts the year's weather was satisfactory for crop growth and yields were satisfactory with the exception of local deficiencies in Usangu and parts of Chunya district. The total rainfall in Rungwe district for 1950 was above average and favourable for all crops. In Iringa district rains started late, were excessive in parts of the lower areas and finished early. In the higher areas of Iringa and Njombe districts the rainy season was prolonged and some crops were damaged by excess of rain.

African Agriculture

The production of food crops was good with the exception of beans and peas. Surplus maize was available for export to other parts of the Territory. The Rungwe paddy crop, although lower, compared favourably with the previous year. The acreage planted was reduced due to flooding of the rice lands at planting time. Coffee producing is increasing in popularity, but more attention is required to established trees to maintain production.

Following the food shortage of 1949 imported supplies of food were received during the early months of the year for townships and employed labour, but when the new crop appeared the food shortages were no longer a problem, and food was plentiful in most areas.

Problems of grain storage have been investigated by the Natural Resources Committee in relation to supplies for a year for employed labour in stores controlled by the Grain Storage Department or their agents. Investigations were also made in regard to supplies for relief of local food shortages in tribal areas. As regards stores under the control of the Grain Storage Department it is considered that existing stores are adequate, but recommendations have been made for the construction in 1951 of grain stores by Native Authorities in the marginal rainfall areas of Mbeya and Chunya districts.

Satisfactory progress is recorded on two important matters towards improving land utilisation by African cultivators:

(a) Controlled grass burning in Uzuiba, Mbeya district and Mufindi, Iringa district was successful and the wanton grass fires, characteristic of previous years, reduced to a minimum.

(b) Deforestation for eleusine cultivation was effectively prevented in parts of Iringa district where attempts were made to ignore the regulations prohibiting this practice.

Notes on the main African grown crops. Maize.—Sales in the market during the past five years in tons were:—

1946		*1947*		*1948*		*1949*		*1950*
3,270	...	8,002	...	8,564	...	4,935	...	7,414

The marketable surplus was good in spite of production being affected by the premature conclusion of the rains in Iringa district. Growth and yields were satisfactory in Mbeya district, but greater yields would be obtained if more attention was given to spacing and wastage of seed at sowing time. In all districts the sowing of too many seeds per hole reacted adversely on growth and productivity, and the special efforts made in Iringa district to get growers to plant less seed per hole met with little response.

Rice.—The quantities of paddy marketed in tons from Rungwe district during the last five years were :—

1946	*1947*	*1948*	*1949*	*1950*
2,821	3,382	2,475	3,664	3,131

The decrease in crop in 1950 was due to a reduction in area planted because of flooding at planting time. Rice is also produced in small quantities in the Usangu area, Mbeya district and Pawaga area, Iringa district for home consumption and local sale. Most of the production at Usangu is on irrigated plots. The Pawaga crop gives an average yield of 1·6 tons paddy per acre. Pawaga is a potential rice area and a market was opened this year when nine tons of hand-hulled rice were sold.

Beans and Peas.—Sales in tons during the previous five years were :—

1946	*1947*	*1948*	*1949*	*1950*
245	625	709	350	307

The quantity of beans marketed was negligible owing to a reduced crop through the early onset of the dry season. Fairly good yields of peas were harvested, but the marketable surplus did not reach the estimated total.

Eleusine.—Climatic conditions were favourable and good yields obtained.

Sorghums.—Yields were disappointing due to the early cessation of the rains. Sales of eleusine and sorghums in tons since 1946 were :—

1946	*1947*	*1948*	*1949*	*1950*
153	209	460	279	160

Wheat.—Production is on the increase in the Poroto mountains and Unyiha Chiefdom of Mbeya district. Sales were negligible because growers retained almost all the crop for home consumption and for seed.

Cassava.—Special attention was given to increase larger and more widespread planting of this crop. This was particularly stressed when the threat of locust invasion became imminent. In Chunya district there was a good response to the propanganda.

Sweet Potatoes.—The planting of this crop was actively encouraged with satisfactory results in all districts.

Sunflower.—In spite of fluctuating prices production was good and 1,194 tons marketed as compared with 1,038 tons in 1949. Production in Mbeya district was almost doubled, increasing from 375 tons to 704 tons, while that of Iringa district dropped from 653 tons to 490 tons.

Potatoes.—The sales from the crop in the Poroto mountains, the main producing area, dropped from over 1,000 tons in 1949 to 755 tons in 1950. The reduced crop was mainly due to blight in the early crop.

Vegetables.—Most of the produce was retained for domestic consumption and recorded sales were considerably lower than in 1949.

Coffee.—Production during the last five years was as follows :—

	1946	*1947*	*1948*	*1949*	*1950*
Rungwe ...	147	194	370	314	321
Mbeya	9·5	33·5	32	61	69·5
Total ...	156·5	227·5	402	375	390·5

The Rungwe crop was marketed through the Rungwe Co-operative Union and the Mbeya crop sold through the Unyiha Coffee Growers Co-operative Society. In Rungwe district it is recorded that there are 6,665 growers who have a total of 1,340,334 trees, about 25 per cent of which are non-bearing young trees, some of which will come into bearing in 1951. Very Considerable areas were planted during the year in Unyiha Chiefdom. Greater attention was paid to pruning established trees, and the Co-operative Society, with the advice of the Agricultural Officer, Mbeya, were responsible for encouraging the use of sprays and sprayers for the control of antestia. Coffee is becoming popular with Africans in the Lupembe area of Njombe district, and an enquiry made by the Agricultural Assistant records that 49 growers have established plots of coffee.

Estate Agriculture

Tobacco is the main estate crop in Iringa district, coffee in Mbeya district and pyrethrum in Njombe district. Tea takes an important place in the Mufindi area of Iringa district and in Rungwe district. Other important estate crops are maize and wheat especially in the Dabaga and Sao Hill areas. Vegetables are produced in considerable quantities, and essential oils on a small scale. The introduction of a bi-weekly air service to Dar es Salaam enabled farmers to open up useful markets for fresh meat, fruits, vegetables and cut flowers.

The welfare of the African employees has been well looked after especially on the tea estate where more permanent houses were built, a medical officer engaged and a modern hospital is to be constructed.

There was a shortage of labour throughout the year and progress was retarded thereby especially on tea, tobacco and coffee estates. Information received from the Tanganyika Tea Company states that some crop was lost during the first half of the year owing to lack of labour and work which should have been undertaken had to be postponed or abandoned.

Owing to the difficult labour position capital has been invested on an appreciable scale on mechanical equipment.

Notes on the main estate grown crops.

Pyrethrum.—Production during the last five years was as follows :—

1946	*1947*	*1948*	*1949*	*1950*
1,066,560 lb. ...	679,948 lb. ...	335,954 lb. ...	337,017 lb. ...	333,545 lb.

Deliveries in lb. each month from the various producing areas were as follows :—

Month	*Iringa*	*Dabaga*	*Uwemba*	*Mufindi*	*Mbeya*	*Total*
January ...	— ...	524 ...	— ...	682 ...	7,842 ...	9,048
February ...	700 ...	683 ...	5,188 ...	328 ...	— ...	6,899
March	6,756 ...	2,426 ...	33,451 ...	— ...	— ...	42,633
April	— ...	4,920 ...	38,459 ...	— ...	— ...	43,379
May	— ...	555 ...	18,077 ...	547 ...	— ...	19,179
June	— ...	5,156 ...	— ...	— ...	— ...	5,156
July	— ...	575 ...	4,412 ...	— ...	— ...	4,987
August	— ...	627 ...	6,000 ...	— ...	— ...	6,627
September ...	— ...	661 ...	15,066 ...	— ...	— ...	15,727
October ...	— ...	5,430 ...	47,341 ...	63 ...	3,183 ...	56,017
November ...	— ...	16,490 ...	61,959 ...	1,124 ...	6,162 ...	85,735
December ...	— ...	7,890 ...	19,733 ...	182 ...	10,353 ...	38,158
Total ...	7,456 ...	45,937 ...	249,686 ...	2,926 ...	27,540 ...	333,545

Production in 1950 compares favourably with the previous two years as the crop had a setback in view of the prolonged 1949 dry season and late start of the rains.

The Agricultural Officer (Experiments) visited the Kenya Department Pyrethrum Research Stations and pyrethrum farms in Kenya during September. This visit was of valuable assistance in relating the information gained in Kenya to the conditions in the Southern Highlands.

The hydraulic press which arrived at Iringa towards the end of the season was in operation during November and December, and is of considerable assistance to the industry. The average price was approximately Shs. 2/- per lb. and at this price the total value of the crop to the Province is estimated to be £33,354.

Coffee.—Production in tons during the past five years was as follows :—

1946	*1947*	*1948*	*1949*	*1950*
60 ...	283 ...	194 ...	345 ...	*294

*Includes 30 tons from Native Administration farms.

As weather conditions during 1950 were favourable for development and production of the crop, the final figure of 264 tons for the year's production of estate coffee other than Native Administration farms was disappointing. It was anticipated the crop would be well over 300 tons. Many factors were responsible for the shortfall in the crop of which damage by white stem borer might be placed first. The value of good cultivation and manuring was appreciated by the majority of the coffee farmers.

Tea.—Tea production in lb. for the past five years was as follows :—

1946	*1947*	*1948*	*1949*	*1950*
1,141,727 ...	1,028,280 ...	1,168,149 ...	1,001,132 ...	1,274,808

The production in the Mufindi area of Iringa district and in Rungwe district in 1950 compared with that of 1949 was :—

	1949		*1950*
Mufindi, Iringa district ...	536,482 lb.	...	777,562 lb.
Rungwe	464,640 lb.	...	497,246 lb.
Total ...	1,001,132 lb.	...	1,274,808 lb.

The Mufindi crop is the highest yet recorded. It has to be borne in mind, however, that areas of young tea are coming into bearing. For the first half of the year rainfall was hardly up to average. From June to December very welcome and useful showers were experienced, in addition the cold months of July, August and September were much milder than usual with a considerable amount of overcast misty weather. These conditions kept the tea in good shape and reflected in the crop obtained. Such conditions have not been experienced for several years. The fields of tea were well maintained in spite of shortage of labour. Sulphate of ammonia was applied for the second year in succession, and the continuation of regular manuring should ensure higher yields per acre in the future. The infilling of young and pruned tea was carried out.

At an average price of Shs. 2/50 per lb. the approximate value of the Southern Highlands tea industry is placed at £159,350. Most of the tea exported went to U.S.A. and Canada and thus earned valuable dollars.

The acreage under tea is 6,855 acres of which 4,912 acres are in Mufindi and 1,943 acres in Rungwe. The Mufindi acreage consists of 3,721 acres mature tea and 991 acres immature tea. In Rungwe district there are 1,673 acres of mature and 270 acres immature tea.

Reafforestation is very much to the fore, and appreciation has been expressed in regard to the action taken in 1950 to protect the tea areas by reafforestation and control of bush fires. The East Mufindi reafforestation scheme which was started in September 1949 has made good progress. Nurseries have been established by the Senior Forester in charge of the scheme, roads laid out and boundaries surveyed. 100 acres were planted last season, and it is expected that a further 500 acres will be planted in the 1950/51 season. The principal trees shall be pine with a mixture of mlanje cedar, cypress, eucalyptus and hagenia. The firebelts will be wattle.

The destructive effects of grass fires so characteristic of the past were eliminated this year due to the firm action taken by the Provincial Administration assisted by the Agricultural and Forest Departments' staff.

The supply of tea seed was adequate and appreciable quantities of tea seed were exported during 1950 from Rungwe district to Kenya and Uganda. The arrangements made with the Department of Agriculture, Kenya, defining the conditions under which tea seed will be permitted into Kenya was of great assistance in the despatch of consignments with the least possible delay. Available supplies are in great demand.

The return to good conditions during the second half of 1950 should have beneficial effects and the prospects for 1951 are good.

Tobacco.—Production for the past five years was :—

1946	... ...	1,029,164 lb.
1947	... ...	749,389 lb.
1948	... ...	1,901,383 lb.
1949	... ...	1,700,915 lb.
1950	... ...	2,863,085 lb.

With the exception of quantities received direct from growers by the East African Tobacco Company Ltd. and the United Africa Co., Ltd. in respect of their continuing contracts, all tobacco was marketed through the Southern Highlands Non-Native Tobacco Growers Union.

The quantities of each grade accepted at the processing plant of the Tobacco Growers Union, and the amounts sold to the East African Tobacco Co., Ltd. and the United Africa Co., Ltd. are shown in the following statement :—

Grade	*Sold to Tobacco Growers Union*	*Sold to East African Tobacco Co., Ltd.*	*Sold to United Africa Co., Ltd.*
1 ...	24,367	29,860	2,544
2 ...	54,530	66,311	4,807
3 ...	36,069	156,150	15,433
4 ...	33,505	28,273	5,781
5A ...	221,500	291,190	19,650
5B ...	299,362	—	9,781
6A ...	359,151	224,141	6,247
6B ...	243,237	—	6,267
7A ...	75,237	43,335	2,076
7B ...	138,730	—	487
8A ...	56,137	611	537
8B ...	31,942	—	—
10B ...	15,658	624	—
10DM ...	56,483	373	414
10DD ...	75,966	—	—
BX ...	—	8,210	501
Air Cured Yellow Special	5,872	—	—
Bonanza ...	3,044	—	—
	1,738,906	849,078	74,525

2,255,345 of the total of 2,863,085 lb. produced were consigned from Iringa during the year.

The average price was Shs. 1/80 per lb. which makes the total value of the crop £256,376.

The variety Ehlers continues as the commercial variety grown, and seed has been imported for a further season. Growers were advised to continue planting Ehlers until the success of any other variety or varieties are assured.

The necessity for economy in the use of fuel for tobacco barns and the planting of trees on tobacco farms for fuel supplies has been stressed, and is a matter of considerable importance to the industry. The Forest Department have restricted the issue of licences to cut fuel in public lands as available supplies are rapidly diminishing.

On many farms the uprooting order was not observed and twenty-four growers were prosecuted for failure to uproot and burn tobacco.

The question of marketing Iringa tobacco in the United Kingdom and the Continent was fully investigated by the Directors of the Tobacco Growers Union, and after full enquiry, arrangements have been made with a United Kingdom firm to act as selling agent for the Union.

The transactions of the Union in its second year have not been without difficulties. Serious matters have been disclosed over claims for several shipments, but after full enquiry into the causes of the claims, and after consultation with the selling agents, the unfortunate mistakes of the past are not likely to be repeated. The Union appointed a General Manager, who took over duties in July 1950 so that the rapidly expanding business of the Union may be administered with efficiency.

Nicotiana Rustica.—22,148 lb. were consigned from Iringa during the year. Many growers report poor results this year. The value of this crop has not yet been fully assessed.

Maize.—Sales of estate maize in tons during the past five years were :—

1946	*1947*	*1948*	*1949*	*1950*
2,459	2,881	2,055	1,189	1,179

A larger area was under cultivation but, owing to crop failures in the Mloa and Ifunda areas in Iringa district, the quantities sold were approximately the same as last year. Considerable quantities of estate grown maize is retained for feeding employed labour, also as a stock feed.

Wheat.—Production of estate grown wheat in tons in Iringa district since 1946 is as follows :—

1946	*1947*	*1948*	*1949*	*1950*
99	47	59	60	350

As a response to the efforts to increase wheat production 2,800 acres were sown. The season as a whole was poor. Rains were patchy in the wheat growing areas of Dabaga and Sao Hill, and there was an extended dry period in April and early May, but heavy showers towards the end of May helped the crop considerably.

Vegetables.—Sales have dropped from 835 tons in 1949 to 251 tons in 1950. The decrease is due to supplies no longer being sent by air to Kongwa and the Southern Province.

Essential Oils.—Production of geranium oil continues on a small scale at Uwemba, Njombe district. Other essential oils are produced on an experimental scale.

Markets and Marketing

The general supervision of markets and marketing passed to the Provincial Produce Officer in 1950. Produce markets were opened in Mbeya district in July and August, and closed in November except for those dealing with

potatoes and peas in the Poroto mountains. Forty-five markets were in operation in Iringa district, and four markets with nine buying posts in Njombe district for controlled crops purchased by Messrs. Unga Limited. In Rungwe district, in addition to fourteen food markets, there were six coffee and four paddy markets in operation during the year. The Mbeya Produce Group marketed the controlled produce of Mbeya and Tukuyu districts.

The following is a comparative statement of the quantities of produce marketed during the past five years together with the estimated value of the 1950 crops :—

	1946	*1947*	*1948*	*1949*	*1950*	*Estimated value 1950*
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	£
Maize	3,270	8,002	8,564	4,935	7,414	74,140
Paddy	2,821	3,367	2,475	3,670	3,228	45,190
Potatoes	244	618	395	1,119	1,034	5,170
Beans and Peas	244	625	709	352	307	5,526
Wheat	98	50	98	95	361	8,200
Coffee	156	610	596	689	664	166,000
Sunflower	—	315	1,300	1,038	1,194	8,977
Vegetables	—	260	966	836	251	1,400
Tea	509	459	521	447	671	159,350
Tobacco	459	334	893	759	984	181,500
Pyrethrum	476	303	149	168	149	33,354

The quantity of produce marketed during 1950 by districts was as follows :—

	Iringa	*Mbeya*	*Rungwe*	*Njombe*	*Total*
Maize, African	2,732	1,771	508	1,224	6,435
Maize, Estate	984	195	—	—	1,179
Paddy	—	—	3,328	—	3,328
Potatoes	140	890	4	—	1,034
Beans and Peas	132	—	—	18	307
Wheat	350	11	—	—	361
Coffee, African	—	69·5	310	—	370
Coffee, Estate	—	294	—	—	294
Sunflower	243	707	—	147	1,194
Vegetables	251	—	—	—	251
Tea	347	—	324	—	671
Tobacco	984	—	—	—	984
Pyrethrum	22	—	—	127	149

Pest and Diseases

Coffee.—White Borer *(Anthores leuconotus)* continued to be by far the most important economic pest. In many instances the insects had burrowed into the main roots of old coffee and seriously damaged the trees. In cases of young coffee the effect of attack by several of these insects was practically to ring bark the trees. *Antestia.*—The incidence of this pest was not serious. Three Africans were trained to undertake tests to enable spraying with D.D.T. to be effectively applied. Sprays and spraying equipment were purchased and maintained by the Unyiha Coffee Growers' Co-operative Society. *Hemileia.*—Little damage was done by this disease. Non-native farmers maintained sprays and equipment and the coffee on most farms was routine sprayed with good results. *Black Tip—Die Back.*—The incidence of

these increased to an alarming extent with the flush of flowers and set of the young crop in October, November and December. *Black Borer (Apate monacha).*—This insect appeared in considerable numbers on certain farms in the Mbosi area during November and December. *Green Scale (Lecanium africanum).*—This did considerable damage to isolated trees on certain farms. *Giant Cricket (Brachytrypes Membranaceus).*—This insect appeared in young coffee plots at Mbosi in large numbers in November and December and caused considerable damage.

Tobacco. Cutworm.—Replanting was necessary where severe damage was caused by cutworms.

Mosaic.—High incidence was reported at Chimala.

Leaf curl.—High incidence was reported at Chimala and in the Mloa area.

Nematode.—This pest was serious on many tobacco farms in Iringa district, especially in the Ruaha valley.

Maize.—Except for *cutworm* which did considerable damage to the young crop and *stalk borer*, maize was relatively free from pests and diseases in Mbeya district. The *American Boll worm* did severe damage to maize and peas in parts of Iringa district.

Wheat.—A heavy attack of *stem* and *glume rust* reduced the yield on the Poroto mountains. *Leaf rust* appeared on wheat in a mild form in Iringa district.

Pyrethrum.—The usual seasonal attack of *thrips* was observed.

Locusts.—Two large mature swarms of red locusts were reported from Uwanda and Ukimbu in Chunya district.

Soil erosion

Useful progress was made during the year in Mbeya district, largely as a result of the operations of the Mbeya Natural Resources Team. The Native Administration co-operated whole-heartedly in this work. The staff of the Agricultural Department were actively concerned with the general observance of the Soil Conservation Rules of the Native Authorities.

The soil conservation gangs continued to work under the direction of a senior instructor. Their work was largely on the Poroto mountains and the hills, and undulating country of Unyiha Chiefdom.

Soil conservation measures were adopted on the majority of alienated lands.

Soil conservation work has progressed in a very satisfactory manner in Iringa district, and contour banks can be seen in most parts of Mufindi, Dabaga, Kalenga and Kiponzero.

The Agricultural Assistant, Njombe, attended a six weeks soil conservation course at Tengeru, Arusha. Work in Njombe district progressed steadily throughout the year, especially in Ukinga Chiefdom and the Lupembe area of Ubena.

The report of the Agricultural Officer (Experiments) appears in Section II of this report.

Mbosi Coffee Sub-station

Early in the year Experiments I, II and III were completely planted with the various coffee varieties in each case. The material except that in Experiment III, was on the small side and weak. Growth at first was fair though somewhat uneven. With the advent of the dry season the weaker plants died back and Experiments I and II in particular became very uneven in plant stand and the growth of the young trees.

The shade trees required by each Experiment were planted and the majority became established before the dry season. Towards the end of the year advantage was taken of the early rains to refill gaps in the coffee and shade trees in all three Experiments. A double row of bananas to form a wind-break, were planted on three sides of Experiments II and III. Pigeon peas were planted around the plots in Experiment I for the same purpose.

Material in the nursery was very uneven, in the case of some varieties it was too poor to be planted out during the year, in the case of other varieties no plants existed in the nursery by the time the rains set in. In all three Experiments a careful check was made of requirements for infilling all varieties and where no material existed at Mbosi the Senior Research Officer was asked to supply from Lyamungu.

Latin Squares III and IV of Experiment I were marked out and the holes dug. No plants of several of the varieties to be planted in these Latin Squares were available at Mbosi nor could they be obtained from Lyamungu during the year. Clearing and stumping of the area adjoining Latin Squares I to IV of Experiment I were commenced and well advanced during the year in preparation for the planting of a crop to test soil variability.

Details of each Experiment are as follows :—

Experiment I.—This is a coffee variety trial with the following varieties at present in two Latin Squares (Latin Squares I and II) :—

Latin Square I P.280. N.5 KP 683 K.351. KP.154 KP.228.

Latin Square II. N.128. P 190 I.60 N.30 KP.683 AB. 35.

Layout 6′ × 6′, Latin Square in each case.

Spacing 8′ × 8′ in both Latin Squares.

Permanent Shade—*Albizzia tangasale*. At the end of the year the average stand of plants in this Experiment was 77 per cent. The varieties with the best stands being KP 154 and I 60 each with 96 per cent. The worst was variety P 190 with a stand of only 27·4 per cent.

Experiment II.—This is a coffee spacing trial with spacing at 6′ × 6′, 7′ × 7′, 8′ × 8′ and 9′ × 9′. There are four Latin Squares each 6 × 6 with split plots for comparison of silico phosphate (a) applied as a single dose at bottom of hole before filling in and single dose in vicinity of seedling roots when planting and (b) silico phosphate as single dose in vicinity of roots only. The varieties of coffee are : P.190, N.39, F.689, P.348, P.147 and P.313 Permanent Shade comprises *Albizzia tangasale*, *Cordi Holstii* and *Millettia* sp. The average stand of plants in this Experiment was 86·4 per cent of which N.39 had a stand of over 97 per cent and P.190 a stand of 75 per cent at the two extremes.

Experiment III.—This is to investigate methods of establishing coffee under Mbosi conditions. It comprises one 8 × 8 Latin Square. In each plot the coffee is uniformly spaced 6′ × 6′. There are sixteen varieties in each plot which is subdivided into two split plots of light varieties each. The varieties are : N.197, R.23, KP.532, N.29, M.97, I.5, AB.92, R.15. Single plant selections in split plots of each main plot. R.11, N.218, M.7, I.49, H.66, KP.423, E.59, KP.263. Single plant selections in split plot.

There are eight main treatments comprising control :—

4 oz. silico phosphate at bottom of planting hole.

4 oz. silico phosphate in vicinity of seedling roots when planted.

2 oz. silico phosphate at bottom of hole when planting plus 2 oz. in vicinity of roots.

Compost plus 4 oz. silico phosphate in bottom of holes.

Compost plus 4 oz. silico phosphate in vicinity of roots when planted.

Compost plus 2 oz. silico phosphate at bottom of hole plus 2 oz. silico phosphate in vicinity of roots. There are three sub-treatments comprising control :

1. oz. nitrate of soda per tree at commencement of rains.

1. oz. nitrate of soda at commencement of rains and in middle of rains.

(As nitrate of soda was unobtainable, sulphate of ammonia was applied in 1950 instead). Permanent shade comprises *Albizzia tangasale*, *Cordia Holstii* and *Millettia* sp.

The stand of coffee in this Experiment was the best of the three Experiments, being 96·4 per cent.

The field trial with a variety of deciduous fruit trees was enlarged by further importations of named varieties from South Africa and the establishment of a number of Queensland nuts.

The *Aleurites Montana* plot was maintained but made disappointingly poor growth.

The two small observation plots of Tropical Kudzu continue to grow well but did not seed. The vines were cut back by a cold spell in August.

Lespedeza (Kobe variety) was grown for seed multiplication and gave a fair yield of seed in June. The Korean variety failed to grow and was lost as all the seed had been sown.

Fisheries

Improvements were made to the production and breeding fish ponds, the sluice gates catchment pits and furrows which were built at Dabaga in 1919.

Owing to unavoidable delays it has not been possible to stock the ponds with Congo species of Tilapia. The ponds have been maintained to receive suitable species of fish as soon as they become available. The Dabaga ponds are intended to act as a source of supply for stocking private fish ponds in the Province.

Southern Highlands Natural Resources show

The show which was held at Mbeya on the 29th and 30th September was organised by a Show Committee nominated by the Natural Resources Committee of the Southern Highlands Provincial Council.

This Committee, under the Chairmanship of Mr. S. M. Gilbert, O.B.E., with Mr. E. T. Ward, as Executive Officer, was a great success and justified the Provincial Council's decision that a show be held.

A grant of Shs. 5,000/- was made by Government, but it was not necessary to use this sum. After meeting all expenses there was a surplus balance of just over Shs. 10,000/-.

The show was opened by His Excellency the Governor, was well attended, and great interest was taken by the general public. The support of Government departments and commercial firms was very good. Entries in the competitive classes, although not so good as anticipated, were not discouraging.

World Agricultural Census

Arrangements were made to hold pilot surveys of acreage and crop yields of African agriculture in the Iringa and Mbeya districts of the Province for the World Agricultural Census. The zones selected in each district were :—

Iringa District : Zone I.—Mufindi.
Zone II.—Kalenga.
Zone III.—Pawaga.

Mbeya District : Zone I.—Usafwa and Umbwila.
Zone II.—Usangu.
Zone III.—Unyiha.

The Census was completed in the zones before the end of the year.

A census of non-African agriculture was also taken.

Seed Potatoes

A crop of the potato variety S53 lo 98 was grown at Ipeta, Upper Dabaga for multiplication and subsequent distribution of blight resistant seed potatoes. This crop was closely watched and the potato virus *Rugose mosaic* was found on the crop. This disease is new to East Africa and a source of danger to the potato industry, therefore the crop was destroyed.

Councils, Boards and Committees

Southern Highlands Provincial Council.

The Provincial Agricultural Officer is an ex-officio member of the Provincial Council which was established in 1950 for one year, and has been extended for another year. The inaugural meeting was held on the 7th March, 1950, the second meeting on the 21st 23rd June, 1950 and the third meeting on the 14th/15th December, 1950. A short report on the activities of the Department in the Province was laid on the table at the two regular meetings.

Natural Resources Committee Southern Highlands Provincial Council

The Provincial Agricultural Officer is Chairman of this committee which is a standing committee appointed by the council. Four meetings were held during the year, and the reports and recommendations made by the committee were discussed by the full council. Questions referring to grain storage, control of bush fires and the Rungwe Small Holders Scheme were considered. The organising committee of the Mbeya Natural Resources Show was appointed by the Natural Resources Committee.

Iringa District Production Committee

The present Committee consists of :—Chairman—Brigadier W. E. H. Scupham, C.M.G., M.C., M.L.C.; Executive Officer—Lt. Col. P. L. A. Hill, O.B.E.: Members—The Provincial Agricultural Officer, the District Commissioner, V. P. Tofas, C. E. Hallam, Brigadier A. S. P. Murray, G. Saleh Haji, E. S. Williams, J. G. de Brito.

The Executive Officer reports on the work of the committee as follows :—

Although the rain during the planting season was, on the whole, satisfactory, two areas appeared to suffer from a prolonged dry spell during February and March. These two areas, Ifunda and Mloa include a considerable number of non-native farms. The wheat crop at Image also suffered. As a result numerous claims under the minimum return scheme were received.

The areas of crops in respect of which claims were submitted were all measured, and every endeavour was made to ensure that payment was made only in the case of failures due to unfavourable weather conditions, as opposed to bad farming. Even so, a very considerable sum had been recommended

by 31st December, 1950, and decisions as to a few claims still remained to be taken.

Claims received up to 31st December, 1950	33
Claims definitely approved in whole or in part up to 31/12/1950	15
Claims rejected up to 31/12/1950	14
Pending	4
Amount recommended ... ... Shs.	41,300

Effort was made to increase the acreage under wheat and approximately 2,800 acres were sown, with an estimated yield of 4,100 bags. This is a disappointing figure, but allowance should be made for the following considerations :—

(a) a substantial acreage was planted by farmers who had had little experience of growing wheat in this Territory. As a result, methods of cultivation were unsatisfactory;

(b) many farmers had failed to appreciate that wheat growing on even only a moderate scale requires a considerable amount of mechanization. Lack of proper harvesting equipment undoubtedly cost many bags of grain, as did also inexperience in the adjustment of newly-received combine harvesters.

The acreage of maize and wheat planted was as follows :—

		1949/50
Maize	Acres	7,300
	Yield in bags	16,500
	Bags per acre	2·3
Wheat	Acres	2,900
	Yield in bags	4,300
	Bags per acre	1·5

Items discussed at meetings: minimum returns. This item has taken up a very large proportion of the committee's time.

Fertiliser concession to wheat growers.—A scheme has been evolved which would appear eminently fair to farmers. Unfortunately, the acreage proposed for wheat growing has not proved to be as large as was expected, nor does it appear that farmers who have been nominated intend to purchase their full allotment of fertiliser.

New farms.—It would seem that the Mloa area must be considered to be a failure in so far as maize and tobacco are concerned, and the majority of farms have been abandoned. The experimental farms at Nzihe will be in production for the first time during the 1950/51 season.

Land Bank.—A number of applications for loans, and for the postponement of the payment of loan instalments, have been dealt with.

Ten meetings were held during the year.

Tea Board.—The Provincial Agricultural Officer as Secretary of the Tea Board, appointed under Ordinance No. 21 of 1938, attended a meeting of the Tea Board in Dar es Salaam on the 8th July, 1950. A new Tea Board was appointed on the 15th December, 1950, under the Tea Ordinance 1950 (No. 31 of 1950).

Southern Highlands Non-Native Tobacco Board.—The Tobacco Board appointed to control the industry through Ordinance No. 17 of 1941, held four meetings during the year and the Provincial Agricultural Officer attended all meetings by invitation.

Southern Highlands Non-Native Tobacco Growers Union.—This Union which was established in 1949 is appointed sole marketing agents for all tobacco produced by non-natives in the Southern Highlands Province, under Government Notice 39/49. The Union is managed by a Board of Directors who are :—

Chairman—H. T. Constantinides.
Members—The Director of Agriculture,
G. Kallis, T. D. Papadimitriu,
F. A. Richards, E. S. Williams,
R. K. Manji.
General Manager and Secretary—D. McQueen.

The Provincial Agricultural Officer represents the Director of Agriculture at all meetings in the absence of the Director of Agriculture. Twenty-one meetings were held during the year. The policy of the Union is to establish overseas markets, increase production and improve the standard of grade with a high percentage of high grades.

The Provincial Agricultural Officer served as a member of the Iringa District Water Board and the Housing Committee, and attended by invitation meetings of the Iringa Tobacco Growers Association.

A. Pitcairn,
Provincial Agricultural Officer

AGRICULTURAL OFFICER (EXPERIMENTS), SOUTHERN HIGHLANDS PROVINCE

General

The year as a whole was rather unsatisfactory from the climate point of view. Excessively heavy rain early in the year damaged tobacco and wheat experiments. Later, when the rains came to a premature conclusion, there was further damage to wheat and linseed experiments (Moshi and Dabaga) from drought. As a result the year's programme of experimental work has yielded a mixed crop of failures and successes. Lack of trained African staff has been a severe handicap to efficient working since everything has to be supervised closely by a European officer. The African staff position was not improved by the resignation of Peter Kiyingi (Recorder : tobacco experiments) just after he had been taught to do his job well.

It is inadvisable to draw hard and fast conclusions from only one year's experimental data, but to summarise the year's work, notes on the principal findings in all trials are given below. Separate detailed reports have been, or are being, submitted for each crop.

Tobacco

Three statistical trials were planted—a variety trial, fertiliser trial and spacing trial. In addition several acres of tobacco were planted to give sufficient leaf for curing a barn every time the plots had to be picked.

Variety Trial.—All varieties yielded about 1,000 lbs. per acre of cured leaf, but Ehlers gave a much higher percentage of bright and medium leaf than White Stem Orinoco, Bonanza and Yellow Special. Yellow Special was the most promising variety after Ehlers. There were no significant differences in yield.

Yield/acre	*Lb.*
Ehlers	1,188
White Stem Orinoco	1,043
Bonanza	1,025
Yellow Special	1,269

Spacing Trial.—Three spacings were tried.

Variety : Ehlers.

Spacing	*Yield lb./acre cured leaf*
4 × 2 feet (5,445 plants/acre)	1,439
3½ × 2 feet (6,350 plants/acre)	1,644
3 × 3 feet (4,840 plants/acre)	1,770

The differences in yield are not significant.

Fertiliser Trial.—A 3 × 3 × 3 N.P.K. fertiliser trial was planted. Damage to the plots by cutworm and rainstorms was so severe as to make the yield data from the experiment valueless. In regard to quality there is a suggestion of an improvement by phosphate. No significant effects were obtained.

Tobacco Farm.—During the latter part of the year the following new buildings were constructed : grading shed, conditioning cellar, large curing barn, labour camp. Old buildings were repaired. During the 1950 season handling and curing facilities on the farm were quite inadequate. The new buildings should ensure much more efficient handling of the crop in 1951.

Wheat

(a) *Fertiliser Trials.*—Two series of trials were planted; one at Dabaga (Ifuenga) and one at Sao Hill (Iheka). Two of the experiments at each centre were designed to test the effect of the following fertilisers at the rates shown :

1. Nitrogen as S/Ammonia at ... ... 0·2 cwt. N/acre.
2. Organics (Farmyard Manure) at ... 5 tons/acre.
3. Soda Phosphate at ... ... 56 lb. P 205/acre.
4. Potash (Muriate) at ... ... 40 lb. K 20/acre.
5. Superphosphate at ... ... 56 lb. P 205/acre.
6. Lime at ... ... 1½ tons/acre.

Sulphate of ammonia, lime and muriate of potash had no effect on yield at Sao Hill or Dabaga. In both cases there was a suggestion of an increase in bushel weight of grain due to potash. Farmyard manure gave an excellent

response amounting, at Sao Hill, to about 2½ bags per acre, and at Dabaga to about 4½ bags per acre. Phosphate gave no response at Dabaga: this appears to be due to incorrect placement. At Sao Hill the response to both soda and superphosphate was roughly equal to the response to farmyard manure (2½ bags). There was no interaction effect from application of both phosphate and farmyard manure.

The third trial at each centre was designed to test the effect of mixing superphosphate with farmyard manure prior to application. Two rates of application of both farmyard manure and supers (5 and 10 tons farmyard manure; 56 and 112 lb. P205/acre) were used, and in all combinations including preliminary mixing of the various possible combinations. Straight effects were similar to those detailed above. If anything there was a decrease in effect of both fertiliser due to the mixing. The higher rate of application of farmyard manure (10 tons) gave a significant increase over the five ton application.

(b) *Variety Trials.*—Three trials were planted. One at Uyole, Mbeya, one at Njiapanda, Mbeya and one at Ifuenga, Dabaga. The latter was a failure. The Mbeya trials were very successful. No one variety proved outstanding but a number show great promise. Further trials are proceeding. Yields were as follows at each centre:—

Variety	*Yield : lb./acre*	
	Uyole (Approx. 6,000 ft.)	*Njiapanda* (Approx. 7,400 ft.)
117. A.	1,340	1,180
Sabanero	1,340	1,832
New Thatch	1,490	880
3381. A.C. 2. E.	1,720	1,400
291. J. 1. I. 1	2,560	2,220
294. 77 C. 6 A.	1,440	1,940
338. A.A. 1. A. 2	2,000	—
184. P. 2. A. 1. F.	1,940	—
Rhodesian Sabanero	1,680	1,460
261. R. 7. C. 1. B.	1,540	1,180
294. B. 2. A. 3	1,560	—
294. H. 2. A. 1	2,330	—
261. S. 10. C. 2. D.	2,540	1,020
Kenya Governor	1,480	920
B. 192. Q. 2. A.L.	1,790	—
Reward	1,480	1,060
Regent 975·6	—	1,860
318. O. 3. B. 2	—	1,240
318. A.J. 4. A. 1	—	1,140
337. B.E. 2. F. 2	—	1,500
DC X Ceres 721	—	1,120

Linseed

Five varieties were tested at five centres, viz.:—

Variety	*Centre*
Redwing	Uwemba (Njombe)
Rio	Mbosi (Mbeya)
Royal	Uyole (Mbeya)
Bison	Njiapanda (Mbeya)
Punjab	Dabaga (Iringa)

The Dabaga trial failed owing to drought. The Mbosi trial suffered severely from drought. The Uwemba trial was severely damaged by unseasonable heavy rain when ready for harvest. The following table summarises the yields :—

Yields (seed) lb./acre

	Punjab	*Rio*	*Royal*	*Bison*	*Redwing*
Uyole	1,152·0	1,512·0	1,148·0	1,222·0	1,150·0
Jjiapanda	1,020·0	584·0	752·0	728·0	726·0
Mbosi	252·0	240·0	194·0	250·0	200·0
Njombe	282·0	308·0	326·0	310·0	289·0
Overall Average ...	676·5	661·0	605·0	627·5	591·25
General Mean ...	(632·22)				
Average for Uyole and Njiapanda only	1,086·0	1,048·0	950·0	975·0	938·0
General Mean for Uyole and Njiapanda	(999·4)				

Yields (oil) lb./acre

	Punjab	*Rio*	*Royal*	*Bison*	*Redwing*
Uyole	561·02	672·84	474·12	512·01	551·41
Njiapanda	496·70	269·88	310·57	305·03	343·44
Mbosi	122·72	106·80	80·12	104·75	95·40
Njombe	137·33	137·06	134·63	129·89	137·85
Overall average ...	329·44	294·14	249·86	262·92	282·02
General Mean ...	(283·67)				
Average for Uyole and Njiapanda only	528·86	466·36	392·34	408·52	447·42
General Mean for Uyole and Njiapanda	(448·70)				

Punjab appears to be the most successful variety for general cultivation.

Jute

The following varieties were tried at Njugiro, Tukuyu :—

Ex-Sudan—*C. olitorius*—ECR/585.
ECR/586
ECR/576.

Ex-India—*C. capsularis*
C. olitorius

So far as fibre production was concerned the trials were a complete failure. Useful quantities of seed of all varieties were harvested which will enable the trials to be continued in 1951.

Pyrethrum

Four fertiliser and spacing (3 × 3 ×3 design) trials were planted at Uwemba. The following singificant effects were obtained. Significant response to superphosphate amounting to about 150 lb. flowers/acre on the average. Significantly higher yield of flowers from 6″ spacing in the row over 9″ and 12″ spacing. 9″ spacing yielding significantly more than 12″ spacing Since final yield figures for the year only recently became available, analysis of all results has not been completed. There *may* be significant responses

to potash and nitrogen. Lime had no effect. Final observations will be found in the detailed report on the experiments which will be prepared soon.

The Agricultural Officer has assisted in pyrethrum breeding work at Uwemba and also visited Kenya to see something of the pyrethrum experimental stations and the pyrethrum farms there.

Niger Seed

Small plots of the Abyssinian high oil content variety were planted at Uwemba and Njiapanda (Mbeya). At Uwemba it yielded seed with an oil content of 35·5 per cent oil and at Njiapanda 38·0 per cent oil.

Grain yield was not recorded at Uwemba because the plot was small and the seed planted on widely spaced ridges originally made for pyrethrum. The yield from the Mbeya trial is not available in Iringa. The Senior Agricultural Officer, Mbeya, is being requested to forward details.

J. S. Gunn,
Agricultural Officer (Experiments)

NORTHERN AND TANGA PROVINCES
PART I—TANGA PROVINCE

Weather Conditions

In the mountainous areas of the Tanga Province the short rains (commencing 1949) were on the low side and practically no "in-between" rains fell at the beginning of the year. However, the main rains opened well in March and were excellent throughout all mountain areas, being well spaced and adequate. In the plains areas excellent rain fell with great benefit to crops. On the coastal belt also the short rains were poor. The long rains had a good start but unfortunately they tailed off rather early, resulting in some loss on marginal land. However, showers of above average intensity fell late in July and continued through September, so much so as to interfere with the harvesting of maize, but they were of great benefit to pulses.

Agriculture in the Districts

General. In the Tanga Province agricultural policy is largely dominated by food production. Over half the territory's sisal production occurs in this province and the huge labour force, totalling over 60,000 men plus many dependants, has to be fed. In addition the tea industry requires food for labour and the port with the township of Tanga is a heavy consumer. The overpopulated Usambara mountain areas, too, often import food as they have done this year and similar shortages in the North Pare area often occur.

The main crop season throughout the Tanga Province was a good one following on the very poor 1949 crops and the failure of the 1949 short rains. Main rains plantings were fairly well up to standard in acreage in most

places and there was throughout 1950 a sufficiency of food in general and fairly good surpluses for sale. In the Korogwe sub-division surpluses of both maize and rice for sale fell considerably and in the Usambaras some importations of food became necessary towards the end of the year. Planting of food on estates was fair. A good deal more might have been planted but planters, particularly on ex-enemy sisal estates knowing they were in their last year of tenure, were reluctant to expend more than was vitally necessary. Several estates that were formerly heavy producers of maize changed hands and consequently in the change-over production of food on these dropped. The Handeni district, the granary of the province, although not reaching the record production of 1948, came well up to expectations in food production, and the Pares produced their normal quota of rice. There was a bumper fly crop of oranges. Coconuts were small in size but copra production was well up in quantity.

The Tanga and Pangani Districts.—As a result of the failure of the 1949 short rains, there was some shortage of food in several of the coastal areas early in the year, but the onset of the long rains soon brought relief. Excellent acreages were planted with cassava at the beginning of the main rains and this planting was followed up with more later on. This, in addition to a good maize crop in the areas suitable for maize, has ensured adequate food supplies in all areas throughout the coastal belt. The coconuts in consequence of the 1949 drought have been small in size throughout 1950 tending to improve towards the end of the year. The main citrus crop failed but the fly crop of oranges reached a new record. Tea production has increased.

The Handeni District. This district had another excellent year. Maize production was well up to average, the surplus for sale exceeding 5,000 tons. As the year was wet, pulses tended to be rather low, many of the crops suffering from too much rain. Tie ridging has been pushed and is tending to increase. With the lessons of previous famines in mind, the Native Treasury has made provision for the construction of large grain stores in case of future droughts. Mtama planting is extending but remains very small still owing to the paucity of suitable varieties that will keep. Africans are taking increased interest in castor seed production. The cotton crop was poor owing to insect pests.

Korogwe Sub-Division (Lushoto District).—This area also had excellent rains. It tends to be the most stable area of the province as far as rainfall is concerned. Planting of rice was below average and the rice crop was low, as also was the maize crop, but there was a sufficiency of food for peasant consumption everywhere and the shortages refer to surpluses for sale only.

Lushoto Sub-Division (Lushoto District).—The 1949 short rains sowing yielded badly in the higher altitudes but well-timed March plantings in 1950, mainly of beans, were successful. In all long rains cropping areas, crops yielded badly in the higher altitudes but well-timed March plantings in 1950, year for distribution to shops for sale to other than estate and urban workers. There has been less pressure on the population to go down to the plains and

cultivate, as was the case until 1949, with the result that the 1948 record of no food importation was not repeated. Rice in the plains has been very short planted this year, many plots which were formerly bunded for hill cultivators to come down and use were left vacant. The mountain area is rather preoccupied with soil conservation work, including the taking out of cultivation of too steep land but this only partly explains the food shortages that have occurred in 1950.

The Pares.—The 1949 short rains in the Pares mainly failed throughout the district but there were some very small surpluses of maize and beans in the South Pares. There was actual food shortage in the North Pares and and small quantity of maize had to be imported in March and April for sale in shops. The main rains, however, were excellent in 1950 and these brought relief. Main-rains crops were good throughout the district with the exception of a small area of the North Pares bordering on the Moshi district. The rice crop in the South Pares was well up to average. Towards the middle of the year a mechanical scheme was started for ploughing of rice areas in the Kihurio and Ndungu areas.

Crop Production

Maize.—The main production was in the Handeni district where 5,412 tons were sold in the markets during the year. There remained a small quantity still for sale at the close of the year but the amount is small. In the Luengera Valley, production fell rather but there was sufficient for local peasant requirements. In the Korogwe area, only 173 tons of native maize was marketed, a poor crop in comparison to 839 tons which was marketed in 1948.

On estates, excellent acreages were planted on those estates that did plant but two large estates which formerly produced planted very little this year. However, there were good yields on the planted acreages except on marginal land. At the time of harvesting in the Muyusi and Ngomeni areas, difficulty was experienced owing to late showers. It is estimated that 5,873 acres of maize was planted on estates.

Sorghum and Millets.—In the marginal areas of the coastal belt, the gradual change over from maize to sorghum is continuing. Individual plots were small owing to limitation of seed, however, collectively, the acreage was well in excess of previous years. Excellent yields were obtained in the Handeni area. The change over has not made much progress in that district, nor has this been the case in the Pare district. Much of the Handeni, Pare and Korogwe areas are marginal for maize and these areas are being pushed to change over to sorghum. However, the difficulties that are being experienced are mainly through the lack of a really suitable short term variety that will keep. In the coastal area, it was a variety of late maturing, white sorghum from Lindi that was planted and there seems no apparent reason why this should not be successful as the coastal areas have a longer rainy period.

Paddy. The main crop in the South Pares was well up to average, the rice passing through the markets totalling 1,505 tons. There are still large areas that cannot be planted owing to water in the primitive irrigation systems not reaching very far from the river. The Kihurio and Ndungu areas were very favourably reported upon by the Rice Commission and plans are in train for a survey of the two areas to be made for the construction of more efficient irrigation which should considerably extend the areas that can be planted to rice. In the Luengera Valley, the bunded blocks in the flood areas of the river were largely vacant this year and the crop has been very small. 117 tons only were marketed during the year and the crop normally planted in the short rains does not look as though it will give more than about 100 tons. The Mkomasi and other small areas around the Usambaras are up to standard and the crops planted at the time of the short rains appear to be yielding well. The Luengera Pilot Furrow Scheme which was designed to take fifty planters only at an acre each as a trial gave excellent crops, the best in the province, the yields being up to 1½ tons per acre. Plans are complete for a survey with a view to the extension of this area and the construction of a large furrow to serve one thousand acres, and this scheme will, it is designed, be surveyed with those in Kihurio and Ndungu. On the coast, acreages were limited and yields were only average to poor. The crops on the coast are grown entirely with rainfall and the failure to obtain a normal crop was due to the tailing off of the rains in May.

Cassava and Sweet Potatoes. The usual drive for cassava planting in the coastal areas was got under way early in the year and resulted in very good acreages being planted up at the beginning of the long rains. Planting continued during the long rains and the results were well up to expectations in that the coastal belt should be independent of importations. The total acreage was well in excess of 1949. In the Handeni district, much remains to be done in the extension of the cassava crop. The crop is very little grown in this district but towards the end of the year blocks of cassava were established on Native Authority shambas in key positions throughout the district with a view to multiplication of planting material so that every taxpayer can have sufficient planting material to plant a quarter of an acre per family. Cassava does well in the Handeni district and the Native Authority blocks are being planted largely with mosaic resistant clones produced by the East African Agriculture and Forestry Research Organisation. These are set out for trial and, if successful, a reservoir of planting material will be available. In the Pare district also, extension could well take place, particularly in the plains and lower slopes of the hills.

In view of the possibilities of locust invasion, every effort is being made to increase this crop throughout the Tanga district, and in all hinterland districts a quarter of an acre to one acre is being insisted upon for each family by the Native Authorities, and where cassava is unsuitable a quarter of an acre of sweet potatoes is being enforced.

Beans and Pulses.—Estate beans were a failure owing to excessive rain, particularly during the flowering period. However, late planted native beans in hill areas did very well and gave good yields. In the coastal belt, several plantings of cowpea and gram were made and fair to good results were obtained. In the Handeni district, the bean and other pulse crop was a partial failure, also through rather too wet conditions. A hundred bags of beans were imported for seed but results were disappointing. There were, however, some good crops in the Korogwe plains and in the higher altitudes of the Usambaras.

Sunflower.—The crop was not widely grown in the province although there is a reasonable amount of interest taken in it. Prices are good but for all that the crop has been falling off during the last two years. It is considered that this is due to over-selling and consequent shortage of seed, for in almost all cases where enquiry has been made as to why sunflower is not planted the inevitable reply is "no seed", and yet this information is from people who previously planted.

Oranges.—Owing to dry conditions at the end of 1949, the main crop of oranges at Muhesa was a complete failure. However, with good long rains followed by favourable conditions from July to September, a record fly crop, which totalled 2,300 tons (1,738 tons marketed by Dalgety's and approximately 500 tons marketed outside the marketing scheme), was obtained. Below, figures of actual controlled sales in tons are given for the years 1944 to 1950 :—

Year	*Main Crop Tons*	*Fly Crop Tons*	*Total Tons*
1944	1,413 ...	200 ...	1,613
1945	1,411 ...	85 ...	1,496
1946	264 ...	920 ...	1,184
1947	278 ...	515 ...	793
1948	1,290 ...	256 ...	1,546
1949	1,180 ...	24 ...	1,204
1950	39* ...	1,738 ...	1,780

*3 tons carry over added.

Monthly purchases in tons during 1949 and 1950 were as follows :—

	1949 Tons	*1950 Tons*	
January	71 ...	3	Fly crop carry from previous year
February	— ...	—	
March	— ...	—	
April	42 ...	—	Main crop.
May	237 ...	24	
June	419 ...	15	
July	310 ...	—	
August	101 ...	6	
September	— ...	199	Fly crop.
October	— ...	557	
November	7 ...	607	
December	17 ...	369	
	1,204 ...	1,780	

Prices paid to growers over the years have been as follows :—

Year	*Price per 1,000 lb. of fruit.*
1944	Shs. 13·52
1945	Shs. 17·00
1946	Shs. 15·80
1947	Shs. 16·13
1948	Shs. 16·14
1949	Shs. 17·56
1950	Shs. 17·36

All fruit offered was purchased.

The following were the distributions during the year :—

	Main Crop lb.	*Fly Crop lb.*	*Total lb.*
Purchases	103,023 ...	4,118,198 ...	4,221,221
Sales	86,324 ...	1,206,079 ...	1,292,403
Used for juice ...	13,405 ...	1,089,667 ...	1,103,872
Discarded	— ...	1,629,315 ...	1,629,315

An experiment was made in sending fresh fruit to Nairobi, Aden and the United Kingdom in diphenyl impregnated wrapping papers. The United Kingdom shipment cannot succeed in face of superior competition, but the shipments to Nairobi and to Aden show promise. The fruit arrived in both places in good condition and in both cases enhanced prices were obtained and buyers expressed a desire for future shipments.

The juice plant worked at full pressure throughout the period of the fly crop but it was impossible to cope with the enormous pressure of fruits which came in daily. 1,629,315 lb. of oranges had to be discarded after purchasing and this has resulted in a loss on the year's working. The total out-turn of juice over the year since the installation of the juice plant in 1917 is as follows :—

1947	3,020 gallons
1948	16,390 gallons
1949	16,920 gallons
1950	33,399 gallons

Financially the industry remains in a not too unhealthy condition, but it is badly undercapitalised. Profit and loss over the years has been :—

1944	net profit £807
1945	net profit £759
1946	net loss £625
1947	net loss £540
1948	net profit £192
1949	net loss £199
1950	net loss £196

It is impossible to put the industry on a really firm financial basis until the large quantities of oranges that finally have to be discarded through rapid ripening are turned to juice expeditiously before they become over-ripe. The pressure of deliveries by many thousands of Africans, all having fresh fruit at the same time, can be dealt with in no other way. Had all the oranges that were discarded been turned to saleable juice in an enlarged juice plant for storing in an extended store in more barrels than the industry possesses, the calculated profit that would have accrued is £3,000.

Plans were put forward in 1949 for the complete reorganization of the industry and the installation of modern plant for juice manufacture, washing of oranges, the preparation of evaporated juice and the extraction of orange oil from the peel. These plans were, however, not acceptable at the time for a variety of reasons and a revised scheme has now been put forward for development in stages. At the close of the year it is necessary to move the whole installation of the juice and fruit packing plant to another site near Mushesa, partly because the site is too small and also because the realignment of the new road to be constructed from Korogwe to Tanga will pass through the plot now occupied. Part of the capital being requested from Local Development Loan Funds will be for moving the whole installation.

Fruit other than Oranges.—In the Tanga Province, bananas are exported from Pangani district and from the Muhesa area are exported also mangoes, grapefruit and tangerines. There are oranges also sold from outside the Muhesa area. Figures for these exports are as follows:—

	1948 *Tons*	*1949* *Tons*	*1950* *Tons*
Bananas exported from Pangani ...	973	1,735	1,698
Mixed fruits consisting of grapefruit, tangerines, lemons, pineapples and pawpaws inclusive of oranges from outside the Muhesa area	1,379	548	543

In addition to the above, small quantities of fruit were sent from the Usambaras to Tanga totalling some thirty tons during the course of the year. These consist of peaches, plums, strawberries and apples.

Coconuts and Copra.—Coconuts have had a fair year following the dry conditions of 1949. Nut yields have been low and of poor quality. Normally the number of nuts per frasila is around 115 but this year the figure rose to as high as 152. An improvement in copra sales was expected towards the end of the year but this did not materialise and it is suspected that much of it has been blackmarketed owing to an expected rise in price. There is no doubt that a certain amount of copra is finding its way to Zanzibar owing to the higher price paid there. Copra sales from 1944 onwards were as follows:—

	Tons
1944	3,494
1945	3,804
1946	3,786
1947	2,684
1948	2,870
1949	5,147
1950	4,557

In the Boza Coconut Plot, where selected coconuts have been planted for trial and multiplication of seed, the young palms continue to make good progress. A new nursery has been planted with a view of filling the blanks caused by casualties due to coconut beetle. Two hundred further palms need to be planted.

Cotton.—Conditions for cotton in the Tanga Province were on the wet side and the crop suffered from the complex of insect pests to an exceptional degree, especially in the Handeni district. The South Pare crop, however, was a bit better and yields in the Korogwe-Mombo area were not too low. Cotton figures for the 1949-1950 season were as follows :—

District	*Seed Cotton in Tons*			*Paid to Growers*
	Grade I	*Grade III*	*Total*	*Shs.*
Handeni	88	26	114	56,217/23
Lushoto (Korogwe)	129	16	145	81,192/33
South Pare	196	24	219	123,086/82
North Pare	128	21	149	81,724/57
Total ...	541	86	627	342,220/95

Coffee.—There are some 1,666 native growers in the Usambaras, some 334,000 plants in bearing and 80,000 under three years old. In view of high prices, new planting has become fairly extensive. Some 26 European estates possess approximately 900 acres of coffee in bearing. Much of this has not been cared for during the last ten years but some rehabilitation of plantations has taken place owing to the present high prices.

The Usambara Native Coffee Growers' Association has now built up a strong reserve of some £4,000. It has been managed practically by this Department up to the present but plans are in train for a co-operative society to be formed early in 1951 and such supervision as is necessary will be carried out by the Registrar of Co-operative Societies.

The North and South Pares native coffee growers have societies formed under the supervision of the Registrar. The estimated crop in the Pare district is 80 tons and that in the Lushoto district at 60 tons. Harvesting in these areas is later than in other parts of the country and the crop is not assembled until February. The 1949-1950 crop in the Usambaras and in the Pares was :—

		Tons
Non-Native	Usambaras ...	70
Native	Usambaras ...	31
Native	Pares	33

Seven and a half tons of robusta coffee was produced in the Handeni and Korogwe areas.

Roll Tobacco.—In the Western Usambaras roll tobacco is the crop that brings in the most cash to the Wasambaa. The bulk of it is produced in the extreme western end of the Usambaras. It is wetted after drying and is rolled into cakes and apparently finds favour in Mombasa because Arabs come to buy it from that area. This year the crop has totalled some 170 tons and it is sold for an average price in the region of Shs. 2 - per kilo: this means

that a sum of some £17,000 has come into the Usambaras for the sale of this crop. Figures for exports from the Usambaras since 1944 are as follows :—

	Tons		Tons
1944	122	1948	69
1945	75	1949	109
1946	137	1950	170
1947	110		

The growers have organised themselves into a society, as yet unregistered, and they impose a levy on themselves of Shs. 2/- per twenty-five kilos sold. The proceeds are banked and are being accumulated for further expenses and for the ultimate registration of a society with employees for better marketing.

Castor Seed.—There has been a good deal of activity at the latter end of the year in collecting castor seed in the Handeni district and planting also has been taking place. Prices have been excellent and this is the primary cause of the activity. The Handeni people are not keen on cotton which is the cash crop recommended to them in addition to maize, as cotton suffers so severely from insect pests. Sales during the year amounted to 111 tons.

Betel Nuts.—This crop was well up to average. Sales for the year amounted to 60 tons as compared to 66 tons in 1949. The crop is not controlled and is in the hands of the Indians and Arabs. Actual sales over the years were as follows :—

	Tons		Tons
1942	50	1947	62
1943	35	1948	68
1944	93	1949	66
1945	41	1950	60
1946	54		

Beeswax and Honey.—Four tons of beeswax and thirteen tons of honey were sold from the Handeni district during the year.

Potatoes.—The potato crop in the Usambaras and the Pares suffered severely as usual from *Phytophthora Infestans*. The crop during the year amounted to thirty-five tons only for sale.

Vegetables.—Vegetable production in the Usambaras for sale to the coast was up to average. Importation of vegetable seed for sale to natives by the Department continued. The usual distribution difficulties still occur in Tanga and in some months of the year it is common to hear that vegetables are unobtainable in Tanga and at the same time that natives in the Usambaras cannot sell their production. The main difficulty is that the public are reluctant to pay a price which will cover a trader for losses due to unsold vegetables. Thus, if a housewife can buy a cabbage direct from a native for twenty cents, she is very reluctant to pay fifty cents to a trader, but the trader must charge a higher price because of the very many cabbages that will

go bad in his shop if they are not sold immediately. This difficulty is probably experienced everywhere on the coast. Production of vegetables from the Usambaras over the years were :—

1945	... ...	625 tons (all supplied to Military)
1946	... ...	390 tons (sales to general public)
1947	... ...	361 do.
1948	... ...	512 do.
1949	... ...	481 do.
1950	... ...	470 do.

The onion crop continues to expand in the Usambaras and to a very limited extent in the Pares. The onions are carried away and sold in Tanga so that the extent of the crop is difficult to judge. However, natives have very readily bought up to three hundredweight of seed at a time and crop failures have not been reported. The crop sold is estimated at 100 tons.

Sisal.—The sisal crop on the Tanga Line appears to have fully recovered from the 1949 drought. The output steadily increased from February when the monthly production was 4,525 tons to 6,210 tons in November. Fibre production (Tanga Line) during the last five years was as follows :—

	Tons
1946	54,727
1947	54,780
1948	62,060
1949	72,349
1950	69,866

The acreage of sisal is over 185,000 acres and the total production comprises well over 50 per cent of the total production of the Territory. 1950 marked the change over of the ownership of the Sisal Research and Experiment Station at Ngomeni which has now been taken over by the Tanganyika Sisal Growers' Association.

Tea.—A second factory has now been opened in the Province in the Eastern Usambaras and production has commenced. A further large estate has been purchased which was formerly undeveloped and is now under development. The total acreage of tea in the Province is 2,167 and the production of made tea for the last five years was as follows :—

	Lb.
1946	339,192
1947	341,029
1948	323,260
1949	452,000
1950	473,864

Cinchona Bark.—Difficulties have been experienced in marketing this crop during 1950 but it is understood that a new market has now been found and exports are being resumed. Production for the last five years was as follows :—

	Tons
1946	92
1947	49
1948	68
1949	70
1950	40

Kapok.—The rather dry conditions during the flowering season proved beneficial and an excellent crop has been harvested which appears to be a record to date. The exports in 1950 amounted to 317 tons, being 208 tons from the Tanga area and 109 tons from Korogwe. It is fairly obvious that a fair proportion of the exported crop this year was held over from last year awaiting a rise in price which materialised during the year. The output was 81 tons in 1949.

Papain.—Two estates on the north and north-west slopes of the Usambaras have restarted production but no figures are as yet available of any sales.

Passion Fruit.—The one estate in the Usambaras that produces has shown a five-fold increase in yield per acre in 1950 following the severe drought that caused negligible production in 1949. Yields were 15,000 lb. in 1949 and 250,000 lb. in 1950. Clear evidence of potash deficiency was obtained by trial on this estate and potash applications have no doubt materially affected yield also. Native interest in the crop is slight in spite of propaganda to popularise the planting of it for sale of fruit.

Ceara Rubber.—Some tappings are reported to be taking place in the Korogwe area but no figures of production are available.

Derris.—The production of this was thirteen tons during the year.

Essential Oil.—Production of bitter orange oil from the Tanga area amounted to 4,500 lb.

Cacao.—The very small quantity of two tons was produced in the Tanga area.

Palm Oil.—The total area under oil palm is just under 300 hectares. Production is eighteen tons oil and twenty-five tons kernel.

Tung Oil.—The acreage remains around 200 in the Eastern Usambaras and production amounted to fourteen tons during the year.

Condiments.—Approximately one-and-a-half tons of black pepper and five tons of chillies were produced during the year.

Sanseviera.—Concessions have been granted in the plains of the Tanga Province and a good deal of activity is going on at the present time owing to high prices. This, owing to the high wages being paid, is tending to upset the planting of food crops, particularly in the Korogwe area.

Pests, Diseases and Vermin

Insect Pests and Diseases.—There was some pink ear rot in maize in the wetter plains areas but this was not extensive. Stem borer was fairly prevalent in the same crop and smut in sorghums was present but did not assume economic importance. Jassid and stainer were very prevalent in cotton in the Handeni district but less so in the South Pares and Korogwe. The insect pests in cotton affected the crop very adversely.

Phytophthora Infestans (Irish Blight) was prevalent as usual throughout the mountain areas where potatoes are grown but prevalence was neither more nor less than usual.

In coffee, borer and antestia are fairly prevalent in both the Pares and in the Usambaras. In tobacco, in the Usambaras, mosaic is very prevalent and few fields can be seen that are not fairly extensively affected. In tomatoes *P. infestans* was widespread and severe. In bananas rather severe weevil damage was found in the Mgwashi area of the Usambaras.

Vermin.—The province does not suffer extensively from vermin except in the Handeni district and in parts of the Pares where damage is rather severe. Pig, buffalo, monkeys baboons and rats are the most destructive, and it is estimated that in parts of the Handeni district probably as much as ten per cent of the crops are lost through vermin. During 1950 a good deal of activity took place on the initiative of the various agricultural instructors who organised gangs for drives. Poisoning, unless following on skilled observation of the habits of vermin, is a very expensive business and really has little effect. Rewards were paid in most areas for destruction of vermin.

Marketing

Native Authority Produce Markets.—The produce markets, started in the Handeni district in 1947, proved even more successful this year than in the past. There were, however, a great number of difficulties owing to differentiations in the price of maize, a higher price being paid for deliveries in 30 bag lots than was paid on the markets. Thus, a native who wished to collect maize after hiring a lorry could, ignoring the Native Authority markets, take the 30 bags to the Grain Storage Department in Korogwe and obtain a price of Shs. 3/85 per bag higher than at markets in Handeni itself. This gave rise to speculation amongst natives as it is impossible to detect whether people had produced maize themselves or whether they had collected maize belonging to their neighbours. There was, thus, at the beginning of the marketing season a certain amount of chaos over transport and also dissatisfaction on the part of the small growers who sold in the markets at lower prices than their more wealthy brothers.

In the Pare district marketing of paddy proceeded smoothly. Road blocks were maintained during the season so that no obvious black-marketing could take place but, owing to the rise in market price during the season, it is not thought that any attempt at selling outside the markets was made.

There still remain improvements to be carried out in the Korogwe area for the marketing of both maize and paddy. This is still done in the form of rounds by traders and is not entirely satisfactory. The volume of produce, however, has so far been rather small and with the drop in production this year, it is not considered that much improvement can take place until production becomes more stable. In regard to the marketing of pulses and

beans, this is not unsatisfactory although it can never be known exactly what is purchased. The production is around the borders of estates and Africans sell direct to the estates. This is not strictly legal nevertheless the system does work; the African gets a satisfactory price and the planter gets what he wants. So far no practicable method has been devised to deal with beans and pulses so that they can be controlled. All marketing of cotton was smooth throughout the season.

Soil Conservation

Both mountain areas in the Province, that is the Pares and the Usambaras, are of necessity always preoccupied with soil conservation work. In the Usambaras all the work is governed by the Usambara Scheme, formerly the Mlalo Scheme but now enlarged to cover the whole of the Usambaras, and this is dealt with below. In the Pare district, owing to staff changes and an officer not being posted to district work for some months during the year, little progress can be recorded. However, some contour banks formerly constructed were maintained although few new ones were put in. In 1949 a demonstration area at Ugweno was to have been started showing three forms of soil conservation on different slopes, but when the scheme came to be put into effect the people objected, hence the funds that had been voted from Development for this scheme were put into a demonstration at the Usangi School Garden which is making excellent progress. There is an instructor in charge in this area and "Hehe" ridging and the use of elephant grass for stall feeding have been successfully demonstrated. Trees also are propagated in the school garden and are given out for planting on steep slopes by Africans.

In the Handeni district there are few mountains and in any case cultivation on steep slopes is not prevalent, being unnecessary, as there is plenty of land for everyone. Tie ridging has been successfully demonstrated in the Native Authority Seed and Demonstration Farm near Handeni itself. There, all the crops planted by natives have been demonstrated with tie ridging and without ridging. In every case, the advantage has been with the tie ridging which has impressed the local population. When sufficient propaganda has been carried out so that everyone is aware of the advantages of tie ridging, Native Authority orders will be issued enforcing this method of cultivation.

Gombero Coconut Scheme

This was devised to prepare copra co-operatively in efficient kilns and by this means to take the preparation of copra out of the hands of the inefficient peasant and place it in the hands of competent people, fully equipped to prepare a first class article. Funds were voted on loan for a trading account and a capital sum was granted for the construction work. The scheme has been successful. A large proportion of the nuts in the Gombero area are brought by natives to the kiln or fetched by the scheme's lorry, and it has been possible to pay a slightly higher price for nuts than the usual price paid in the district and still to show a profit for the repayment of the loan. There are, however, disturbing elements. Africans have debts which

they prefer to pay for in coconuts to small traders so that, although the scheme is successful, it is not yet working to full capacity. The local Digo Association have been very active in assisting this Department in putting the scheme over, but all the members of the Association are not always loyal. The advantages of the scheme, have, it is thought, been well demonstrated and requests have been made to establish kilns in other areas. However, owing to the wide scattering of palms in areas other than Gombero, it is considered not practicable to start any further schemes unless some form of obligation be placed upon the contributors to a new scheme to deliver all their nuts to central kilns.

The Usambara Scheme (Mlalo Rehabilitation Scheme)

At the end of 1949 the report of the Mlalo Rehabilitation Scheme was presented and this showed that the population in the particular area studied was increasing and that the average land held per family was 3·4 acres. The report further showed that certain measures of control of erosion and of soil rehabilitation are vitally necessary if the Wasambaa are to continue cultivating in their mountains. Based on the findings and the study of the previous years in the Mlalo Basin, the larger Usambara Scheme has now emerged. This scheme aims at equal pressure throughout the mountain areas, to "put over" the soil conservation methods that were devised in the Mlalo area and at the same time to take land that is too steep for cultivation out of cultivation for annual crops and after a period to get it under forest trees or bananas. At the same time, the pressure that is being exercised in the mountains tends, it is now contended, to reduce the acreage of land available for the population, so that the scheme has now extended also to embrace trials and extension to sparsely populated areas below the mountains where people can go to cultivate food. It was only towards the close of the year that the Scheme has really got under way following a fairly long period of propaganda to acquaint the Native Authorities and the population with what is afoot. At the end of the year, however, a certain amount of progress can be recorded, and the selected areas, spread over the whole Usambara mountain block in which rehabilitation and soil conservation measures are being pressed, are tending to show at least some of the desired results.

Seed Farms

The Native Authority Seed Farm at Handeni was maintained and multiplication of sorghums and other staple crops was carried out. A demonstration of tie ridging which commenced in 1949 with a five year rotation is mentioned under Soil Conservation.

The Native Authority Citrus Demonstration Plot and seed farm at Muhesa was maintained during the year.

Kungului Farm, Lushoto

As indicated in previous reports *Phytophthora infestans* arrived in the Usambaras c. 1943 in common with the rest of East Africa, and since then the Usambaras have suffered a good deal through food shortages owing to the almost complete disappearance of their important staple food—the European potato. Importations of blight resistant varieties have been taking place for some years but owing to various strains of blights cropping up which are unknown elsewhere the work has been beset with many difficulties. In 1948, a variety, 9144(91), introduced from Scotland, which had been resistant to blight for some three years finally went down with a new strain of blight and work had to be recommenced on other varieties. In 1950 three plantings and two harvests of fifteen varieties still remaining under trial were made. Of these the varieties 1521(5), 1564(14) and 1583(22), all originally from Corstorphine, Scotland, seem the most promising. No. *P. infestans* has been identified on the plantings during the year but was seen on neighbouring local varieties. The multiplication of these three varieties is proceeding and fresh varieties are being bred at Corstorphine for importation and trial next year.

Various development works were carried out to the farm during the year; a good deal of elephant grass was planted for feeding to cattle and also to supply planting material to areas in the Usambaras that should receive it. Yellow sweet lupin was planted for multiplication and trial as a green manure. It seeded very well but its growth was not luxuriant. Nodulation occurred but the crop might be better after growing again on the same land or by inoculating seed before sowing. The collection of eighteen varieties of sweet potatoes, commenced in 1947, was maintained and another variety from Handeni district was added. Notes are being kept of maturity period and yields in the plots. The grass, *Pennisetum salifax*, which has proved under trial successful as a terrace face plant was planted where necessary.

A collection of apple and plum stocks was obtained from Kenya and planted for budding or grafting next year. The intention is to determine the most suitable stocks for well proven Usambaras varieties. Observation plots of *Telfaria pedata* (oyster nut) and of passion fruit were planted. The small plot of coffee is being changed to multiple stem and given banana shade and mulching. Stocks of peppermint and oil lavender were maintained. Various vegetable seeds from South Africa and from Australia were tried for suitability to the Usambaras.

Mechanical Cultivation Schemes

Two schemes were started during the year in the province, one in the Kihurio Ndungu area in the Pare District and one in the Luengera and Mombo areas of the Korogwe sub-division of the Lushoto District. Both schemes were based on Massey-Harris tractors and both suffered from false starts owing to initial difficulties with spares. At the close of the year both machines are working satisfactorily.

The Pare Scheme.—This was based on ploughing land for the cultivation of rice. The Africans paid the hire charges of Shs. 30 - per acre without difficulty and the scheme proceeded smoothly from all points of view except that shortage of spares caused hold-ups to be largely in excess of ploughing hours achieved. Another factor is that little new land was broken, practically all land that was ploughed being land formerly turned with the hoe, thus no notable increased rice production is likely to accrue from the effort. When frequent hold-ups for lack of spares occurred a ploughing contractor was invited to participate and he, with larger machines, came in on hire charges paid by Africans and very satisfactorily ploughed a larger acreage than was achieved by the government sponsored unit. The results of the scheme remain to be seen in the current rice season but ploughing achieved was—

	Acres
Ploughed by outside contractor	336
Ploughing Scheme—Massey-Harris ploughed ...	255
Total ...	591

The Scheme was supervised by an Agricultural Assistant.

The Korogwe Scheme.—It was decided to change the emphasis of the scheme and instead of devoting the ploughing unit to food production, it was agreed to combine it with the extending of the Usambara Scheme which aims at the rehabilitation of the mountains of Korogwe and Lushoto and also making land available on the plains below for cultivation by the very dense population of the hills. Land is in process of being cleared at various points below the mountains for trial of crops suitable in the various conditions. When the tractor parts now en route are fitted, the machinery will be taken over by the Native Authority for ploughing this land and for the settlement plans under the Usambara Scheme.

World Agricultural Census

This could not be carried out all over the province owing to staff difficulties and also food shortages in some places following the 1949 drought. It was finally confined to non-native agriculture and the Usambara mountains. In the two chosen African sections instructors and other staff were engaged on and off for seven months. In the case of non-natives it was found necessary in some cases for each estate to be visited by the officer concerned to obtain accurate statistics. The sisal industry, however, responded well and forms were forthcoming from most sisal estates with little delay. The census was completed at the end of the year.

Fish Farming

In co-operation with the Fisheries Officer at Korogwe, on the site of the Department's fresh water fisheries, a trial was made of fish production with a growing rice crop in the same fish-pond. Local paddy was used. The

trial demonstrated that rice and fish can be propagated together, but a long term paddy will be necessary. The rice take longer to mature than the local paddy so that with the local varieties it was necessary in the trial to harvest the rice in standing water leaving the fish to mature, whereas for efficient propagation of rice and fish, the latter should be removed when the paddy is emptied leaving the rice to dry off and ripen. New, long term varieties of rice are being imported for trial with fish farming.

The Game and all Agricultural officers in the Region continued to put the Fisheries Officer in touch with all those interested in fish-farming.

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PART II—NORTHERN PROVINCE

WEATHER CONDITIONS

Moshi.—The rainfall was excellent in Moshi. The 1949-50 rains were well distributed and then the main rains commencing in early March and continuing to the end of May were well distributed throughout the whole period. The result has been very good crops on the whole, particularly maize. On the eastern slopes of the mountain, high intensity showers occurred in March when there was no cover on the ground and some excessive wash resulted, but this type of damage did not take place in other parts of the district. The 1950-51 short rains have been very poor indeed, and in parts have failed completely. At Ngare Nairobi near the forest line, very good rain fell towards the end of the year amounting to over twelve inches in parts.

Arusha.—The total annual rainfall was considerably above the average of the past twenty years but the bulk of it fell over a period of some two months following fairly satisfactory and well distributed short rains. The long rains commenced in the middle of March and continued well into May. During this time the precipitation was on the heavy side and there were several cases of severe flooding and damage. The short rains at the end of the year have been disappointing. Some rain fell in early November but then petered out. At the end of the year rain is very badly needed to sustain perennial and annual crops.

Mbulu.—Rainfall was excellent. The short rains started off well in December, 1949, and continued through January. This was followed by a short dry spell in February but in March the main rains opened in earnest and continued on through April and most of May. The 1950-51 short rains have been disappointing and such small rainfall as has occurred in November and December has been well below average. The short rains may be said to have practically failed.

Agriculture in the Districts

General.—At the beginning of the year the province was on the whole rather short of food after the poor 1949 crop year. Indeed, in Mbulu 600 tons of maize and beans had to be imported. However, short-rains crops brought relief and following the main-rains crops, the whole province can be said to have had a really bumper year. Most crops have brought records for sale. Wheat gave the biggest estate and African total ever recorded and the maize crop also has been a record. The native coffee crop is higher than last year though non-native coffee has been rather disappointing. There has been a general improvement in the condition of cattle during the year: supplies of milk have been good throughout the cattle areas of Mbulu. In the drier areas of Arusha, there were some partial crop failures, however, although these were not in any way serious but keen competition for irrigation water in these took place and still does. In Arusha, also, towards the end of the year there was a shortage of bananas although seasonal rains had, before the close of the year, brought these on. This too was not in any way serious.

The Moshi District.—On the whole the district has had an excellent year: a record of maize has been produced, the native coffee crop is well above average, eleusine, bananas and root crops have all done well and the cotton crop is the largest for some years. The onion crop was disappointing, as also was the Rongai potato crop, and estate coffee was under average but at the end of the year indications are that the next crop will be a good one. A little progress was made with soil conservation measures on native lands and better progress was made on the wheat land at Nzare Nairobi where estates are commencing to construct terraces.

The Arusha District.—This district also had an excellent year and the maize crop here makes 1950 the best recorded as regards production. The native crop increased and, whilst beans decreased, the crop of haricot beans exceeded all expectations. Non-native coffee has been rather disappointing, much buni being produced this year. Towards the second half of the year the banana crop was very short and natives complained but towards the end of the year improvement was discernible. Damage was done by falls of rain of very high intensity on one or two estates. The production of seeds was well up to average in so far as beans were concerned but peas suffered and exports of seed peas are down. Pyrethrum planting has increased as new

plantings have come into bearing. The season in the Arusha district as in Moshi, was a poor one for onions and the production in Arusha was only a little more than half that of 1949. Cotton was very disappointing and planting was below average.

The Mbulu District.—The season's planting was above average in all areas. As the result of the previous famine year everyone was anxious to get in as much as possible as early as they possibly could. With the excellent season, the harvest was therefore a good one. There were good surpluses of maize, wheat and mtama for sale. However, early beans suffered from too much rain and there was some shedding of maize in the higher rainfall areas. There was also an infestation of army worm in Goroa and most of the maize crop was lost, but in that area this was more than made up by an excellent sorghum crop. In Mbugwe there was only an average crop of sorghum due to heavy infestation of stalk borer. Wheat plantings were on a large scale and the district has produced a record crop, the largest proportion being the non-native crop at Karatu and Oldeani. The Mbulu Development Scheme has made excellent progress and the culling of cattle was commenced during the year without trouble and is continuing successfully.

Masailand.—In common with the rest of the province Masailand had good rains. This district practises little agriculture and what there is requires a good deal of improvement. Nevertheless, in the scattered agricultural areas, good crops were harvested and in the non-agricultural areas grazing has been adequate.

Crop Production

Maize.—The total maize crop surplus for sale in the province during the year amounted to 23,810 tons which sets a record. Of this, 10,354 tons was native produced and 13,456 tons estate maize. It is noteworthy that 8,061 tons of the total was native maize sold in Moshi. The season for maize growth was excellent, the rains were on the early side and no long dry periods occurred. In the Moshi district it is reported that some yields were up to eighteen bags per acre in the main maize belt. In the Arusha district, the recently settled Loljoro area made a notable contribution to the crop, and sisal estates were again able to grow much of the maize required to feed their labour and even to contribute to the surplus for sale. There has been little increase in the mechanical harvesting of the crop and throughout the season an acute labour shortage was experienced. In some cases considerable losses were caused by theft and by termites. At the end of the year, some maize is even still being harvested. Pink ear rot did a fair amount of damage in the Moshi area and to a lesser degree in the Arusha area, but the damage was not too serious because it was possible to separate infected cobs by hand before sale. The Mbulu district, too had an excellent crop and there are good surpluses available everywhere, so much so that there are sales of maize

taking place in the Mbulu district and these may total as much as 500 tons which is unusual in this district which so often imports food. Production over the last six years was as follows :—

	Tons
1945	9,273
1946	3,391
1947	11,314
1948	17,597
1949	8,223
1950	23,810

Wheat.—The total wheat crop for the province amounted to 7,475 tons which constitutes a record. The largest contributor was the Mbulu district where the Oldeani and Karatu areas contributed 4,500 tons. In those areas, one yield is recorded seventeen bags per acre and yields of ten to twelve bags to the acre were fairly common. The average yield in Oldeani and Karatu was 8·1 bags per acre. The excellent conditions and harvests in the Mbulu district were rather a contrast to the record of several failures in Arusha where weather conditions were on the wet side. In that district those who planted early often had their land smothered in weeds while those who planted late suffered from black stem-rust later on. However, in spite of these few failures, Arusha made a substantial contribution to the record crop of the province, but the average yield was reduced to 2·6 bags per acre. The Ngare Nairobi area in the Moshi district produced 2,223 tons; the average yield there was 4·8 bags per acre but there were some heavier yields in the higher areas where rainfall is better near the forest line. In those particular areas up to nine bags per acre were recorded. The lowest altitude farms in the Ngare Nairobi area suffered partial failure. The following table gives wheat production over the years :—

	Tons
1943	3,111
1944	4,701
1945	3,288
1946	2,886
1947	2,259
1948	3,662
1949	4,315
1950	7,475

Sorghums and Millet.—Sorghum is a staple crop of the people of Mbugwe below the Rift wall in the Mbulu district where both red and white varieties are grown. Although they had a good rain year their crop was only average owing to heavy infestation by stalk borer. In some portions of the chiefdom, infestation was as high as 100 per cent. Measures are being taken to ensure that in future the fields are cleaned up and all plants uprooted and burned in an effort to control the pest. However, in spite of the bad year, the people have small surpluses of sorghum which is finding its way above the Rift and care is being taken that oversales are not made. The chiefdom of Goroa also grows a considerable amount of red and white sorghum and they had a bumper crop this year which more than made up for the maize failure. The crops here are also finding their way above the Rift. In the dry areas above

the Rift more sorghum was planted than usual and this, it is considered, is a step in the right direction for the more sorghum that the Mbulu district can plant, almost to the exclusion of maize, the better.

Trials of sorghum have taken place in both Moshi and Arusha areas but suitable varieties acceptable to the people have not been found. The varieties tried have all been either too soft if they were short maturing, or too long maturing if the were good keepers, and much work is necessary with this crop, particularly in the lower areas of the Moshi district and those of Arusha, in order to get the dry country cultivated to relieve the overcrowded mountains.

Eleusine.—This crop is grown extensively by the Chagga in the Moshi district and is primarily a beer crop. This year the crop was poor in most of the district due to too much rain, but on the eastern slopes of Kilimanjaro some very good yields were obtained. It is impossible to give figures of production as the crop is all consumed locally. Due to shortage in and around Moshi, prices rose to as high as Shs. 100/- a bag in June and dropped to Shs. 80/- a bag when the dry season eleusine was produced towards the end of the year.

Pulses.—The total crop of mixed beans in the province of which there are sales records was 783 tons. There were some fairly good crops taken off the higher altitudes of Kilimanjaro where it is customary to plant all the year round, but generally the mixed bean crop throughout the province has been below average. Much of the mixed bean surplus for sale came from seed bean rejects. On the other hand, haricot beans have produced the excellent surplus for sale of 2,232 tons, of which 692 tons were from Moshi and the balance from the Arusha district. Most of these are exported as food beans to overseas sources.

The cowpea crop, both of the 1949-50 season and the present plantings at the end of the year on Kilimanjaro, has failed.

Bananas.—The preceding two years of poor rainfall have had a bad effect on the banana crop of both Mounts Meru and Kilimanjaro and bananas have been scarce practically throughout the year, the first half of the year more scarce in Moshi but in Arusha in the second half of the year. However, throughout the banana growing areas at the end of the year bearing is again approaching normal and as far as can be foreseen there will be good supplies from now on.

Root Crops.—European potatoes were in short supply. Rongai, in the Moshi district, the main producing area, was cut off by bad roads during the harvest and most of the crop was taken over the border into Kenya. In other parts, the crop was only fair due to *P. infestans* which was severe in some places. The disease was encouraged by the damp weather from July to September. Actually, there was sold in Moshi only 94 tons and the total crop of the province that changed hands was only 133 tons. Two blight-resistant varieties were imported from Kenya for trial, 835A and 914A (91), but both

varieties failed. They were planted at too low an altitude, namely, approximately 2,000 feet and also at about 3,900 feet, and in a dry period of the year when lack of rain did not improve them. Neither variety was affected by *P. infestans*, the failure being due to other causes.

Cassava is not a popular crop in the Northern Province, probably the biggest acreages of it are to be found in Mbulu. However, propaganda is being carried out for cassava to be planted in the lower, dry areas as an insurance against locust damage, and the same propaganda is being spread for the planting of sweet potatoes in the higher altitudes. Generally, crops of sweet potatoes on the mountains have been good this year but there is room for much extension of this sure crop.

Sunflower.—The sunflower crop of the Northern Province is reported to have reached 1,186 tons. In the Moshi district this crop is increasing in popularity. The Mbulu district produced a little, approximately fifteen tons. The bulk of the crop has been produced in the Arusha districts, some being grown by estates.

Coffee.—The season has been a late one and picking is still going on at the close of the year. The estate crop tonnage is down. The estimate for the year has been 1,900 tons of parchment and this is now stated to be on the higher side. 1950 is evidently the low yielding year in the biennial bearing from which estate coffee suffers when allowed to overbear. In Oldeani, however, a hot, dry, windy spell at flowering time certainly had an adverse effect on the crop and in Arusha, very dry weather when the crop was swelling resulted in much bunt. If estate coffee is in the low bearing year then native coffee should be in the opposite period for everywhere increased crops are reported. The Kilimanjaro native crop is estimated at 4,800 tons parchment, and the Arusha native crop is stated to be 400 tons—double the previous crop. Figures of production in the province over the last five years in parchment were as follows :—

	Native Tons		*Estate* Tons
1945/46	3,196	...	2,992
1946/47	2,479	...	827
1947/48	4,429	...	2,635
1948/49	3,399	...	1,301
1949/50	4,225	...	2,246
1950/51 Estimate	4,800	...	1,900

Moshi Native Coffee Board.—Reports to the Board so far indicate that the 1950-51 crop is good in quality especially in the grades. The beans are on the whole bigger and heavier this year with a higher proportion than usual of AA, A and B grades.

In February, a growers' committee, on which the Moshi Native Coffee Board was represented by its Executive Officer, visited London to negotiate an increase of price with the Ministry of Food. The negotiations resulted in a rise in price of 103 per cent. This means that the average Moshi native crop is worth at Mombasa nearly one million pounds sterling. In view of

this increase, and of expanding activities, the Board increased its levy to 11 cents per lb. of parchment, thus bringing its revenue up to some £45,000.

In July, Mr. J. P. Waterer, B.Sc.(Hort.) took up the appointment of Horticultural Officer under the Board. After an initial period at the Coffee Research Station, he took over the propagation centres, of which there are ten around the mountain. The main work at the centres was devoted to care of plantings, cleared land and raising seedlings from selected seed. Three latin squares were planted bringing the total to six and planting of "mother" trees was extended.

The K.N.C.U. Coffee School is directed by a School Committee and derives its funds from the Board. Further developments took place and the intake was sixty pupils. The site of the school is at Lyamungu Estate, eighty acres of which were allocated to the school by the Director of Agriculture when the estate was acquired by the Department of Agriculture.

The Tanganyika Coffee Curing Co. Ltd.—This company is directed and owned by the Tanganyika Coffee Growers' Association and the Moshi Native Coffee Board jointly. Since last season further alterations have been made and more equipment purchased for more efficient handling of the crop. The total out-turn by the company in 1949-50 was 6,080 tons of clean coffee. The capacity of the plant is sufficient to deal with the parchment crop of mild coffee of the whole territory and plans are made for next year to extend plant to deal with all buni also. The Regional Assistant Director of Agriculture served as a director of the company representing the Moshi Native Coffee Board towards the end of the year.

Cotton.—The crop in the Moshi district has been considerably better than for some years. The slightly increased price induced the planting of a much larger acreage and weather conditions were favourable. Pests and diseases were slight. In the Arusha district, a particular attempt was made to increase production and the Agricultural Assistant devoted a good deal of time to it, but he was not successful in raising much enthusiam. It is estimated that the crop will reach only about thirty tons and much cotton was lost through straying cattle destroying growing crops. The Mbulu crop was also negligible. There was not much interest displayed in that district and a little only is planted around Mbugwe. The crop there should reach eighteen tons. Cotton figures for the season are given below :—

Seed cotton in Tons

District	*Grade I*	*Grade III*	*Total*	*Paid to Growers* Shs.
Moshi	478·528 ...	67·663 ...	546·191 ...	303,041·90
Arusha	23·832 ...	7·349 ...	31·181 ...	15,888·14
Mbulu	12·210 ...	4·248 ...	16·458 ...	7,517·56
Total ...	514·570 ...	79·260 ...	593·830 ...	326,447·60

Onions.—The crop was a disappointing one this year and this was due primarily to continued wet weather from March to May and frequent showers during June, July and August which resulted in poor development and

some rotting of the bulbs. The seed for the crop arrived rather late December, 1949 and, moreover, the germination was poor resulting after a while in poor sales and one ton of this seed is as yet unsold. The total crop for the year amounted to 1,320 tons and was roughly evenly divided between Moshi and Arusha with a small quantity percolating from Mbulu. The figures of onion sales over the year were as follows :—

	1944 *Tons*	*1945* *Tons*	*1946* *Tons*	*1947* *Tons*	*1948* *Tons*	*1949* *Tons*	*1950* *Tons*
Moshi	1,156	875	740	991	830	1,154	586
Mbulu/Arusha ...	764	1,325	943	967	1,255	1,037	734
Total ...	1,920	2,200	1,683	1,958	2,085	2,191	1,320

Export Seeds.—The crop on the whole in the 1949-50 season was satisfactory and quality also was good. The final figures for the 1948-49 crop are shown below. The 1950-51 crop has also been satisfactory and exports are now taking place. Quality is well up to standard although some of the earlier plantings suffered rather from too much rain. The Seeds Board continued in its control of the industry but owing to the absence of a suitable person in Arusha Township, the Agricultural Officer had to continue as Executive Officer to the Board. Several improvements in the Ordinance and in the Rules were effected during the year minimising the chances of evasion, so that the high quality on which the industry depends for its success can be maintained.

The prices received by growers were very similar to those of last year but exports were axed by the temporary closing down of the South African market but this, however, was lifted later, and seeds were exported to America, Canada, South Africa, France, Australia and the United Kingdom.

In the 1950-51 crop, seed peas suffered from insect pests to such an extent that the crop was considerably reduced. Seed beans had rather a wide showing of mosaic and, where possible, fields were inspected by the Plant Pathologist who devotes a good deal of time to the seed industry during the growing season. Production was as follows :—

	Tons
1948–49	1,655
1949–50	1,401

Deliveries at the end of 1950 in the 1950-51 crops have so far amounted to 914 tons with an estimate of 300 tons still to be exported.

Sisal.—The sisal industry suffered from labour shortage in common with the rest of the Northern Province, however production was well up. The following figures show the tonnage produced over the past five years :—

	Tons
1946	5,886
1947	4,767
1948	5,100
1949	5,980
1950	5,930

Papain.—During the year, interest in this crop continued to wane and little was produced. Recently, it has been noted that the demand and price were rising and good quality papain has been commanding some Shs. 20 - per lb. and even more. In spite of this, there seems to be little interest and there are still fields of neglected pawpaw to be seen and very little new planting has taken place. Exports for the past five years have been :

	Tons
1946	39
1947	55
1948	21
1949	28
1950	5

Pyrethrum.—Production is increasing again as recent plantings come into bearing. All pyrethrum grown in this province is sold on pyrethrins content and this has averaged above 1·5 per cent which is now regarded as standard. The Kenya Farmers' Association acted as agents and again the closest touch was maintained with the Pyrethrum Board of Kenya, and the Senior Agricultural Officer (Pyrethrum) of the Kenya Department toured the growing areas of this territory with much benefit to growers. The Agricultural Officer, Arusha, attended board meetings of both Boards and also visited the Research Station at Ol Kalou. The season during 1950 was an excellent one. Production during the last five years was as follows :—

	Tons
1946	298
1947	204
1948	101
1949	91
1950	144

Paddy.—With the extended irrigation schemes that have been taking place in the Moshi district, the popularity of rice as a crop has been increasing. Little rice was ever sold before but with the stimulation of good prices, together with ease of planting because of irrigation, 94 tons were actually marketed but probably in addition double this quantity was produced for local consumption. There is no doubt that paddy as a crop in the Mbulu district is on the increase, particularly too with the shifting of population which is taking place from congested to more open areas. In the Moshi district a little rice is also planted and there, better organisation of markets has helped to increase the crop. Approximately 100 tons was sold in the Moshi district to the approved agents. The Northern Province is not a heavy rice producer, much of the crop consumed has to come from the Tanga Province.

Sugar.—Production in 1950 on the one estate in the Moshi district was the highest on record with 8,055 tons of refined sugar and 135 tons of brown sugar. The heaviest production is from August to November inclusive. In June, two 4 × 4 latin squares were laid down to determine the effect of sulphate of ammonia at 0, 2, 4 and 6 cwts. per acre. So far the indication are that the higher rates of application give a green leaf and on the whole a sturdier

plant. Further trials on N. P and K. treatments are planned and the layout has already been given to the company. Mr. Turner, Sugar Agronomist from Jamaica, visited the plantation in December, 1950, and gave some very interesting and useful advice on soil management. Soil management in the saline areas of the Pangani basin is, it will be appreciated, the biggest problem that the sugar estate has to face. Production for the last three years was as follows :—

	Tons
1948	6,088
1949	7,429
1950	8,055

Minor Crops.—Small quantities of chillies and groundnuts are grown in areas below the Rift in the Mbulu district. Three tons of garlic also was sold from the same areas during the year but production of this crop was rather larger in previous years. Castor seed also is being planted in the same areas and 140 acres are known to have been set out during 1950.

Marketing

There are few organised markets under the Native Authorities in the Northern Province and some improvement in marketing of crops could with advantage be explored. In the Moshi district this exploration was started during the year and it would appear that, if acceptable to the Africans, there would be certain advantages in markets around Kilimanjaro. It is alleged that a good deal of produce from the Moshi district near the Kenya border goes into Kenya and that as much as a thousand tons of maize and several hundred tons of potatoes, as an example, are lost to this territory in that way. Coffee through the co-operatives and other organisations is efficiently handled; only the Meru coffee in Arusha remains to be got completely under control although even this is marketed co-operatively under one trader. This also remains to be improved. In the Mbulu district twelve produce markets were opened during the year.

Pests, Diseases and Vermin

Coffee. Antestia.—Since the introduction of D.D.T. applied as a one per cent emulsion at eight gallons per acre on native coffee and as a 0·1 per cent at eighty gallons on estate coffee, there has been a notable reduction in antestia damage to coffee beans. Great care is exercised in the time of application so that no spraying is carried out at flowering time.

Stem borer.—The position is likely to become serious unless checked. The pest is attacking coffee in higher altitudes than was seen previously; in other words, stem borer is travelling up the mountains in coffee estates. The native grown coffee, despite the efforts of the Moshi Native Coffee Board and Agricultural Department instructors, still has far too much borer whilst many of the neglected non-native estates provide serious breeding grounds. At the close of the year, following a report by the Entomologist on the whole

situation, a campaign is planned and will be started early in 1951, and the Moshi Native Coffee Board is appointing a European Officer to supervise the work on African coffee. An Agricultural Officer of the Department will also be available for from two to three months to devote his time exclusively to this work. In the other areas, the situation is not reported to be so serious, particularly in the Mbulu district, but in the native coffee of Arusha a borer campaign has been going on for some months with increasing intensity under the Agricultural Assistant.

Thrips.—The damp, cloudy conditions after the rains were not very favourable and little damage was seen. However, the failure of the short rains at the end of the year, giving occasional showers with hot dry periods between, may well produce an attack. D.D.T. spraying will commence again as soon as flowering has finished and this should probably control any potential outbreak.

Hemileia.—This has been quite prevalent, rather more on native than on estate coffee. On the latter, in most cases, Bordeaux spraying is often standard practice, and at the end of the year one or two planters in the Arusha area are having their coffee sprayed by a contracting spraying firm who have recently set up in Nairobi.

Onions.—Thrips attack was not severe this year. A few enterprising natives sprayed with D.D.T. with good effect.

Wheat. Rusts.—As the season was a wet one more disease was in evidence this year than in the previous two drier years. At the latter end of the season, black stem-rust was widespread but the appearance was fortunately too late to cause large losses except in the lower altitude where susceptible varieties suffered. Yellow rust which does its damage in the higher altitude caused some loss also. Leaf rust was more widespread than usual and, with black stem-rust, reduced yields, particularly in the lower areas.

The Senior Plant Breeder from the Kenya Department paid a valuable visit to the area during the season. Tests conducted for him on samples collected during his visit have revealed the presence of a new physiologic form of black stem-rust. Unfortunately many of the wheat varieties planted in these areas are susceptible to this new strain. The Senior Plant Breeder has made his recommendations of varieties for the different areas for next planting season, and both this Department and the wheat planting community places on record its indebtedness to him and to the Department of Agriculture, Kenya, for his valuable help.

Maize and Sorghum.—Pink ear rot on maize was very prevalent in the Moshi district and caused quite a stir at harvest time. All natives and non-natives had to be warned by circular of the toxic effects of pink ear rot affected grains if left in bags in too great a quantity. Separation took place with shelling after this advice was issued and infected cobs were sorted out

fairly efficiently so that finally no consignments were being refused acceptance by the Grain Storage Department on the score of pink ear rot. In the Arusha area some fields were affected but intensity was not as great as in Moshi, and in Mbulu little was heard of pink ear rot.

Stalk borer.—There was a far greater incidence this year than in the previous two years. The practice of planting all the year round in the mountain areas where irrigation is available, is it is feared, causing the increase of this pest. This problem has been discussed for many years and close seasons have been freely mentioned, but no definite measures have resulted, mainly because with the shortage of land in all mountain areas nothing can really be done to impose a close season. Some control was effected by applying gammexane immediately after the first damage was seen. Observation plots are planned for trial with gammexane treatment.

Stalk borer was also severe in sorghum in the Mbugwe area of the Mbulu district where nearly half the chieftdom had 100 per cent infestation.

Smut.—In trials planted in various parts of the province smut made its appearance but it was not reported as being of great economic importance this year in the Mbulu district where the most sorghum is grown.

Banana Weevil.—There is little change in the position since last year. The instructors in the lower areas have standing orders to inform all growers of control measures and see that they are carried out. Banana weevil is more or less fairly widespread but no report of any particularly bad infestation have been received.

Vermin.—Baboon and pig did fairly extensive damage to maize in the lower and higher altitude areas of the Moshi district. Pigs are more prevalent in the lower areas and there the natives largely deal with them themselves, but baboons in the higher altitudes are a serious menace and a good deal of activity in tribal turnouts took place to reduce the population of these animals.

Tengeru Farm

On 1st July, the Natural Resources Sub-Committee of the Provincial Committee took over the Polish Refugee Organisation the area of the Polish Refugee Camp at Tengeru. The Soil Conservation Service had already taken over roughly 300 acres and the sub-committee took over the remaining 600 acres, 100 of which was held to become at a later stage the headquarters of the Game Preservation Department.

The 500 acres contains the farm and dairy of the refugee organisation and this was purchased by Government. The capital of £12,500 and a trading suspense account of £2,000 were allocated to this office, and the Regional Assistant Director of Agriculture was appointed executive of the sub-committee to take over and supervise the running of the farm. The services of the Polish farm manager, a mechanic and six women dairy and

farm assistants were retained. The farm is intended eventually to become an agricultural experiment station and also a Natural Resources Training School for African staff for the Natural Resources Departments. The school is to be run by the Education Department, meanwhile the capital and suspense account are being used to maintain the farm on a profit basis and to repay the cost over a period of years.

On 31st December, 1950, the following livestock were on the farm :—

Bulls	12
Cows	225
Heifers, two years and upwards	40
Bull calves, 1-2 years	1
Bull calves, up to 1 year	33
Heifer calves, 1-2 years	7
Heifer calves, up to 1 year	99
Working oxen	20
Donkeys	19
Horses	1
Pigs	209
	666

During the six months since the farm was taken over, it produced 414,063 lb. of milk from which was sold 184,270 lb. of fresh milk, 8,111 lb. of butter and 588 lb. of cream. In addition twenty-two tons of vegetables, thirty-eight tons of maize and nine tons of beans were produced as well as a quarter-ton of barley and rye.

When the farm was taken over the buildings were in a state of disrepair, the dam on the river burst just after the transfer and implements had to be bought. The financial position is shown below :—

Suspense Account	*Shs.*
Balance on account, cash and sundry debtors	31,572·79
Value of seeds, feed and crops in store	3,919·31
Nominal value of cattle and livestock increase (value based on original purchase prices and not on the enhanced present, market values)	5,847·40
	41,339·50
Less Shs. 40,000 voted	40,000·00
Net profit	1,339·50

However, though the profit for the six months seems small, stock feed has gone up in price and dairy products remain the same price. The following were paid also from current funds :—

	Shs.
Repairs to Mlala Dam (share)...	3,919·31
Repairs to buildings	5,232·58
	9,151·89

Capital Account	*Shs.*
Amount voted	250,000
Amount spent on acquiring buildings, livestock, implements and plant, etc.	214,430
Balance unspent	35,570

At the close of the year the Education Department are investigating sites and plans for the commencement of the Natural Resources Training School and, when the time comes for that Department to commence, a reduction of livestock by sale should show a profit on the original sums voted. Meanwhile the farm fulfils a public need in supplying fresh dairy products to Arusha and some agricultural experimental work is planned for 1951.

Soil Conservation and Land Useage

A good deal of work is being carried out by the Soil Conservation Service, which is stationed at Tengeru in this province, on European estates in the Arusha and the Mbulu districts. Those estates in the Ol Motoni area of Arusha that have agreed to their farms being laid out have got well under way, and in the Ngare Nairobi non-native wheat lands progress is also being made. In the Mbulu district, progress is reported from the Oldeani areas where machinery belonging to the Soil Conservation Service is working also.

In regard to soil conservation work on native lands, a good deal of progress is reported from the Mbulu district; a total of 83,900 yards of contour banks were constructed and 5,762 shambas were treated by diversion ditches. All African fields in South Iraqw now have diversion ditches dug or marked, and in this area each man has been made responsible for digging his own diversion ditch. Demonstrations of tie-ridging and contour banking have been continued on the Development Farm near Mbulu, and a bench terrace demonstration at Dandi has proved very successful (but only after a heavy application of farmyard manure). A tie-ridging demonstration has been put in on one of the local sub-chief's shambas near Mbulu, and at Karatu a demonstration of bench terracing is being laid out. A number of pilot schemes for strip cropping on the contour have been started at Karatu and in the other wheat areas.

In the Moshi district, there is always considerable trouble in the breaking of contour banks that have been constructed in the past and instructors urge the reconstruction of these as a routine measure and lay out new contour banks where necessary. Good work was done at Marangu and Mwika reconstructing banks and planting elephant grass, and plans have been made to establish elephant grass blocks on all the Moshi Native Coffee Board nurseries so that planting material will be available wherever required around the mountain. One new tendency is noticeable in the Moshi district and that is that cultivation is starting on slopes that are rather steep and which were previously kept for grass growing. There is no doubt that measurement of slopes on Kilimanjaro should take place and that land that is too steep must be protected before the practice gets too far under way. Demonstrations of tie-ridging have been laid out at Marangu and Mbokom and these are side by side with formed bench terraces. From a record kept while these were being made (the bench terraces), it was found that one man could shift three tons of earth a distance of eight feet in one day.

In Arusha a survey was made by the Soil Conservation Service of the Ol Motoni basin area and the land above the new Taveta-Namanga road to show what soil conservation is necessary and to draw attention to the rapid deterioration of the land. The crux of the whole control of these areas lies in the movement of cattle and until fresh land is found for grazing the hordes of cattle that move up and down these hills, no soil conservation measures that are taken to deal with the land can be successful. The matter is under enquiry by the District Team.

Development Plan

Purchase of Fruit Trees, Kilimanjaro.—In the past fruit trees have been purchased from Development funds for planting on the Moshi Native Coffee Board nurseries in various parts of Kilimanjaro. These trees are intended to be used as a supply of bud wood for the propagation of more trees for issue to Africans if the varieties chosen prove successful. Of the trees planted in the past, there is a definite relation to altitude and success of the different types. Apples do best at higher altitudes around 6,000 feet and of these "King of Tomkins County", "Delicious", and "Rome Beauty" are showing great promise. In the lower areas, peaches and plums show promise, plums rather more than the peaches. The varieties of plum, "Beauty" and "Santa Rosa", are promising, and amongst the peaches "Improved Waldo" and "Killiecrankie" are doing well. New varieties are being ordered next year.

Soil Conservation, Eastern Kilimanjaro.—The survey of Rombo with enumeration of stock and measurement of pasture areas which was scheduled to take place has not yet been attempted owing to shortage of staff. Immediately after the 1950 rains, elephant grass was planted on as many contour banks as possible and this has taken very well. Contour banks have been made up but the Coleus hedges planted on them do not hold the soil sufficiently well and it is obvious that elephant grass is a far better plant and the people appear to be realising it. Demonstrations have been put in of tie-ridging, formed bench terraces using contour banks planted with elephant grass and made bench terraces. Manual labour was used to shift the soil.

Demonstration of Strip Cropping.—An area of low rainfall was deliberately chosen in the Mwika Chini area and a block of four acres was divided into four plots of one acre each. Plots one to three held an acre of sorghum, one-sixth acre beans, one-sixth acre cotton and one-sixth acre sunflower. Plots two and four held grass—one-third acre *Setaria* spp., one-third acre *Chloris gayana* and one-third acre *Brachiaria brizantha*. Unfortunately most of the trial was destroyed by monkeys and birds as wells as grasshoppers but the grasses did demonstrate that Brachiaria was easily the best, giving an excellent cover and a large percentage of leaf, and it might prove valuable as a fodder crop in this area. The Rhodes grass unfortunately failed to germinate. It will be little use continuing with this strip cropping trial unless some form of fencing is efficiently constructed.

Improvement of Furrows (Moshi Lowlands).—This work unfortunately had to lapse with the departure of the Agricultural Assistant from Moshi in 1950, but some small, essential works to protect past works were carried out towards the end of the year with the assistance of the District Administration.

Development—Mpuli District

This Development Scheme is based on a five year plan and 1950 is the third year. Briefly, the plan is to develop 600 square miles of uninhabited country by discriminative tsetse bush clearing and the provision of water for the resettlement of six thousand families and their stock and, at the same time, to rehabilitate the eroded country now occupied by arranging a better distribution of population and stock, as well as reducing stock numbers by culling. Hand in hand with this, animal husbandry and agricultural methods must be improved, better soil and water conservation measures must be used and grazing reserves must be developed. Irrigation and swamp cultivation is being extended, improved and studied.

The Tsetse Survey and Reclamation Department have carried out extensive surveys and clearings and tribal turnouts have been able to follow these surveys. A good deal of progress has been made. A total of some 161 square miles has been treated, and as most of the selected areas are to connect areas that are already open or to surround areas so as to cut off the movement of fly, a huge area of land has now been made available, and much of this is ready for resettlement while some awaits only provision of water supplies.

The destocking programme provides for the reduction of stock numbers as follows :—

Central Iraqw	52 per cent
South Iraqw	32 per cent
North Iraqw	10 per cent

The destocking programme is based on an estimated carrying capacity of 3·5 acres per head of cattle in Central and South Iraqw and six acres in North Iraqw. A start was made in April and July but this failed as the cattle market was quiet and there was difficulty in absorbing the cattle presented for sale. A slump in prices also occurred. However, towards the end of the year, the market improved. An order under the Destocking Rules was issued in September for the sale of at least twelve per cent of stock from Central Iraqw during 1950. The reduced culling rate was adopted because of market uncertainty. However, as prices had increased the twelve per cent destocking was achieved without trouble. In all, 30,000 stock units were sold from the district during 1950.

Various resettlement pilot schemes have been started in various parts of the district with mixed success. In some cases, particularly with the Barabaig, the people have been unwilling to move in but in other areas, particularly in Karatu in the areas which were formerly occupied by European short term leases, there has been no difficulty.

Two pilot mechanical schemes have been laid out in the Katatu area on the contoured strip-cropping system with contour banks, and with 50 per cent grass and 50 per cent arable. The basis for laying this out is that the width of the strips is approximately fifty yards each, but in practice the width varies as slopes are not uniform. The basis of allocation of land is around ten acres and of these five acres are cultivated and five are under grass. In the wheat lands, two African individuals have purchased tractors.

Central Farm, Ndungidor.—Methods of cultivation and soil conservation on four separate blocks of four varying soil types and on slopes varying from four to fourteen degrees have been laid down. Trials of oats, barley and wheat are also being carried out together with trials of a number of grasses.

Demonstration Sub-Station, Daudi.—This is a one-acre bench terrace demonstration laid down in 1948. It has produced good results with heavy manuring and the use of paid labour. It was planted to maize, wheat and sorghum.

Demonstration Sub-Station, Dongobesh.—This contains multiplication plots of grasses, sweet potatoes and short term sorghums for trial. Elephant grass also is being multiplied under irrigation, the intention being to plant this grass down the sides of the Dongobesh River.

Demonstration Sub-Station, Babati.—Trials for the past two years have been conducted on the comparative merits of maize and sorghum. The conclusions reached so far are that maize is quicker but is unreliable. The safest planting time for maize appears to be mid-January. Sorghum is the most reliable grain crop tried locally.

Land Settlement

The African Settlement Team was established at Moshi under a Deputy Provincial Commissioner, and with various officers attached including an Agricultural Officer who has co-operated with the officer of this region in his work. The team took over five farms which had reverted to Africans and these were successfully settled. The remainder of the farms that are to revert in the Moshi and Arusha districts have been allowed to remain in the possession of their European occupants for the 1949 crop season and, as these have just been vacated, large-scale settlement is only just beginning. Plans have been approved and the layout almost completed in most cases and the settlement of all these farms should be completed by March, 1951. Much of the land required for Africans, however, cannot be permanently settled until water is provided and its provision will take time. The team has planned various dams to be constructed and various irrigation schemes have been scheduled. Other means of obtaining water are also under investigation.

The Agricultural Officer carried out sorghum trials, also trials of fodder and soya beans, and has carried out various extension work, such as a ploughing scheme in the Arusha area and assisting Africans in all their agricultural problems on new settlement. He laid out three 5 × 5 latin squares with concrete furrows, V notches and valves, preparatory to starting

an irrigation and salinity experiment early in 1951. This has been done in co-operation with the Arusha Chini Sugar Estate and also with the Agricultural Officer in charge of the district.

At the close of the year, the work of the team is being absorbed into the various district organisations.

Production Committees

Moshi District Production Committee.—The committee met on twelve occasions during the year and two special meetings were held. Loans totalling £16,000 were recommended by the Committee and in several cases they also recommended an extension of time for outstanding loans. One claim of Shs. 2,020/- for breaking grant was paid and a further claim for Shs. 380/- awaits payment. Outstanding claims for Guaranteed Minimum Returns from 1949 amounting to Shs. 25,381/- have been paid. Claims for the extra Shs. 20/- Guaranteed Minimum Return payment in respect of wheat have yet to be submitted and paid. One prosecution was made but was quashed on appeal.

Planting programmes indicated that 9,253 acres were planted by estates to maize and it is revealed that at present there are 21,700 acres of arable land under crops.

Arusha District Production Committee.—The committee held eleven ordinary meetings and representatives attended a joint meeting with Moshi and Mbulu at Moshi to meet the Director of Agriculture on June 11th. Guaranteed Minimum Crop Returns to the value of Shs. 77,703/14 were paid out, of which Shs. 34,757/74 were delayed claims from 1949.

Mbulu District Production Committee.—The committee held seven ordinary meetings and representatives attended the joint meeting with Arusha and Moshi to meet the Director of Agriculture mentioned in the above paragraph. Guaranteed Minimum Crop Returns to the value of Shs. 1,158/60 were paid out.

World Agricultural Census

There was some difficulty about getting Africans to co-operate over this and finally only in the Mbulu district has the full census been carried out. It worked smoothly but, of course, took up on and off some seven months of the time of African Instructors.

In regard to non-native estates, in each district of the province the work was carried out by the Executive Officer of the Production Committees concerned and supervised and assisted, as necessary, by the Agricultural Officer of the district. This has also gone smoothly and returns were submitted at the end of the year, both native and non-native.

Conclusion

The Department of Agriculture acknowledges the co-operation of all other officers of Government and of the farming community in its work.

C. J. McGregor,
Regional Assistant Director of Agriculture

SOUTHERN PROVINCE

Climate Conditions

Although study of rainfall figures indicate that in most Districts rainfall was above average it was not a fully satisfactory year as rain was too intensified during certain periods: distribution was uncertain and erratic. Nevertheless, it would be unfair to place the blame on the weather for the failure to meet all Provincial requirements for food supplies. Largely must the blame be placed upon human shortcomings.

In some areas there were indications of early rains in October and November, but there was no really satisfactory rainfall for planting in a large way until Christmas.

Food Crops and Food Supplies

This has been a disappointing year for the purpose of being self-sufficent within the Province, for provision of food for the employers of fed labour. There were also many local food shortages although most of these were alleviated by internal distribution. Some of the local shortages were accountable to climatic conditions, e.g. floods on the Ruvuma and the erratic incidence of rainfall.

The fact remains, however, that there could have been no such shortages if the rules of cassava plantings had been fully implemented. In a good grain year little cassava is needed, but within the economic range it is a marketable commodity for export. The price is, however, low and compares unfavourably with other crops, e.g., sunflower, cashew nuts and tobacco. It is not, therefore, popular as an economic crop. Unfortunate as it is to have to instigate innumerable prosecutions, it is essential to enforce the rules for minimum plots of cassava as an insurance against food shortage.

It is estimated that it will be necessary to import approximately 2,000 tons of grain, but some 624 tons of paddy have been exported to set against this.

Appendices relevant to food crops and food supplies are attached herewith as follows:—

Appendix "A" —Produce Market Intake Figures.
Appendix "B" —Produce purchased by Grain Storage, or controlled by E.C.B.
Appendix "C" —Export Figures.

Notes on crops follow but for tabulated figures the above appendices should be referred to.

Crop Production

Sorghum.—The production of this was disappointing whereas 5,031 tons are shown as having passed through markets 2,338 tons were brought in to the Grain Storage Department. This compares with 6,581 tons and 1,042 tons respectively in 1949.

Maize.—A great deal of the earlier planted maize is eaten in the green stage as the people usually have inadequate food reserves and require the early crops to eke out their food supplies. 4,164 tons were shown as having passed through markets and 3,358 tons were taken in by the Grain Storage. This compares with 3,440 tons and 3,563 tons respectively in 1949. The fact that in 1949 the amount taken in by Grain Storage exceeds the market intake is due to direct purchase of a specialty which did not pass through the markets.

Paddy and Rice.—Crops were good except on the Rovuma River where considerable destruction occurred through abnormally high flood. 2,783 tons were shown as having passed through markets of which 624 tons were exported, the remainder having been used for local distribution. It is hoped to increase the production of this by mechanical means and the mechanical ploughing schemes will be dealt with in a later paragraph. 1,291 tons were marketed in 1949, there were no exports.

Cassava.—A serious decline in the planting of this has caused concern. Over recent years the peasant has become increasingly money conscious and has been developing the idea that if you have money you cannot be short of food. The need for keeping up the regular annual planting of this has been demonstrated only too clearly in 1950. Market intake figures were 1,252 tons as compared with 6,041 tons in 1949 and only 96 tons were exported as compared with 5,860 tons in 1949.

Sesame.—Production of sesame has been poor in 1950. This is not due to pests and diseases and poor climatic conditions, but because less was cultivated. Market figures show 1,740 tons of which 1,387 tons were exported and 151 tons were milled locally. Figures for 1949 were 1,710 tons, 1,196 tons and 237 tons respectively.

Groundnuts.—A reasonable quantity of groundnuts was produced. Market returns show 1,259 tons as having been taken in; exports were only twenty-one tons, so that the production was absorbed within the Province by employers of fed labour, and other consumers. Comparative figures for 1949 were 967 tons marketed and 168 tons exported.

Cashew Nuts.—A record export tonnage of cashew nuts was achieved, 4,787 tons. Although this figure is only 200 tons higher than the export in 1948 there were consignments estimated at some 1,500 tons awaiting shipment in early January, 1951. Good prices have stimulated keen competition amongst traders. Other aspects in regard to development of the crop will be found in a later section of this report covering development plans.

Pulses.—Market figures reveal that 2,733 tons passed through markets of which only sixty-three tons were exported as compared with fifty-three tons in 1949. The remainder was absorbed within the Province. The main

produce is cowpea and under the heading "pulses" are included, pigeon pea, bambarra nuts and fiwi.

Sisal and Tow.—Exports again declined somewhat. 9,983 tons have been exported as compared with 11,389 in 1949. It is considered that the reduction is due to an increase in the acreage of immature plantings owing to uprooting and re-planting.

Coconuts and Copra.—Exports of copra declined in 1950 to 735 tons as compared with 1,379 tons in 1949. 208 tons were milled locally as compared with 372 tons in 1949. There is a heavy demand for the green nuts and it is more profitable and entails less work for the producer to sell the green nuts. Some progress has been made in coconut sanitation during the year. Following the study of records from the recorded plantations, nuts are now available for sale as seed from consistently high yielding trees. It is hoped to introduce kiln drying of copra in a small way in Mikindani. The Southern Oil Mills who are the main local purchasers of copra for soap making wish to erect a kiln and will then probably purchase nuts for the purpose of producing edible oil as well as soap.

Tobacco.—The record crop of 1,275 tons of leaf was purchased by the Ngoni-Matengo Co-operative Marketing Union in 1950 as compared with the previous record crop in 1949 of 888 tons. In general it is reported that there will be a lower percentage of the higher grades. The percentage of factory losses is likely to be high and it is estimated that the amount of exportable leaf will amount to some 830 tons only. These losses are accountable to the fact that the old factory is quite inadequate for dealing with this quantity of tobacco.

Excellent progress has been made in building the new factory and it should be ready to deal with next season's crop.

Very heavy expenditure has been incurred and it was found necessary to raise a loan. If the Songea/Lindi road remained open throughout the wet season it would ease the financial situation, as consignments of tobacco are evacuated as fast as they can grade, condition and bale the tobacco in Songea. It is likely, however, that the road will be closed for a few months and hence cause delay in the sale of tobacco.

Full meetings of the Songea Native Tobacco Board were held on the 29th May and the 6th November, 1950 and were attended by the Provincial Agricultural Officer. Only 185 tons of tobacco are shown as having been exported from Lindi but figures for export through Mbamba-Bay have not been received. Some fifteen tons only of coil tobacco were exported in 1950 compared with twenty-four tons in 1949. Other aspects of tobacco development in the Province are dealt with in a later paragraph under Development Plans.

Coffee.—The coffee crop in Songea is reported as being 110 tons of parchment in 1950 as compared with fifty tons in 1949. This coffee is being sent to Moshi, to be cured by the Coffee Curing Works there. There is evidence of some increase in plantings. The price has risen to a very high level, almost fantastically high, and this has caused the comparatively small crop of Songea to be one of some value.

Wheat.—This was a poor year for wheat in Songea. The target aimed for was 750 tons in order to provide for the maximum output of the mills at Peramiho Mission. Only 203 tons are reported as having come in. This is attributed to the fact that the price is low as compared with economic crops such as tobacco, coffee and sunflower seed, and this does not encourage its production, although the price was raised from twelve cents to twenty cents. It is also believed that a certain amount may have been consumed or sold by the growers for local native consumption on account of food shortage.

Potatoes.—The potato industry was nearly wrecked in 1950 on account of traders at Matamanga purchasing ungraded potatoes: there was a high percentage of potatoes the size of marbles. The larger merchants in Lindi immediately ceased to buy and to recommence importing from Kenya. A meeting of the trade was hastily convened in the Provincial Commissioner's Office where it was pointed out that fault lay with the small up-country traders who act as their agents. It is difficult to blame the native producers. So long as the traders purchase low quality potatoes so will the native producer continue to sell low quality potatoes. The minimum size has now been laid down for bulk sales out of the Tunduru District.

Cotton.—It was a poor season for cotton, the following are the amounts of seed cotton purchased in 1950.

District	"A" Kilos	"C" Kilos	Total Kilos
Tunduru	28,767	—	28,767
Mtua	5,188	1,195	6,383
Mikindani	5,508	58	5,566
Total 1950	39,463	1,253	40,716
Totals 1949	179,279	2,528	178,807

Production of lint was as follows :—

District	Bales AR	Bales BR	Lb. AR	Lb. BR	Lb. Total
Tunduru	103	—	41,200	—	41,200
Mtua	30	2	12,000	800	12,800
Mikindani	35	2	5,630	828	6,458
Totals 1950	168	4	58,830	1,628	60,458
Totals 1949	—	—	121,008	1,716	122,724

Sunflower.—Production of sunflower seed rose considerably during 1950 rather to the detriment of food production in Songea and Tunduru. 1,259 tons are recorded as having been exported in 1950 as compared with 578 tons in 1949. It is not desired to restrict the production of a valuable oil seed but it is of little value if it causes food shortages.

Millets.—Millets are not popular as a food and any surplus over requirements for beer brewing is sold. 458 tons are reported as having passed through markets and 422 tons were purchased by Grain Storage as compared with 650 tons and 339 tons respectively in 1949.

Beeswax.—Export of this has declined considerably; only eighty-six tons have been exported in 1950 as compared with 174 tons in 1949. The Development Plant envisages the development of this industry, particularly in the Tunduru District where it is hoped that a Beeswax Officer and trained African staff will be posted in 1951.

Gum Copal.—Export of gum has declined slightly, twenty-five tons have been exported in 1950 as compared with twenty-eight tons in 1949.

Mangrove Bark.—The export figures show that 750 tons have been exported in 1950 as compared with 1,296 tons in 1949. This however, is not a true export inasmuch as it has transpired that this was only a coastwise export within the Province. Most areas are closed for mangrove cutting for the purpose of regeneration.

Colombo Root.—Export of this declined in 1950, 124 tons have been exported as compared with 227 in 1949. The price has been from 11 - to 12/- per frasila.

Native Starch.—This has continued to decline and export in 1950 was negligible, two tons only as compared with fourteen tons in 1949. Between 1944 and 1947 exports were from 100 to 300 tons annually.

Castor Seed.—Exports of this product rose during 1950, ninety-four tons having been exported as compared with 61½ tons in 1949.

Export

A table of exports is given at Appendix "C" for 1950 with figures for the years 1944-49 for comparison.

Markets and Marketing

Marketing arrangements are improving steadily. The imposition of market fees is designed to raise funds for the building of permanent brick markets instead of temporary pole and thatch buildings which require renewal every year. Market receipts and records are to be standardised within the Province. This improvement will be most valuable in connection with the Development Plan which commences in 1951.

Accurate market returns will be the indicator of the progress of the plan in so for as native production is concerned. Market returns for 1950 are given at Appendix "A" with figures for the preceding two years for purpose of comparison.

Soil Conservation

With the exception of the Matengo Highlands where the pit system is made compulsory, the system universally advocated is tie-ridging. Slow progress is being made but the adoption of this will be part of the task of the increased staff anticipated as the result of the Development Plan. Coupled with these measures efforts are being made to have cassava plantings on tied ridges. There are so many advantages in doing so, which are briefly given below. Unfortunately verbal propaganda, however logical, is a poor weapon with which to combat indolence.

(a) There is every reason to believe that largely increased yields are obtained.

(b) The tie ridges constitute soil conservation measures.

(c) The tie ridges hold up all rainfall that falls on them which may be of the greatest value in a year of poor rainfall.

(d) Planting on ridges avoids the rotting of cuttings in the early stage of growth of which people complain when planting on the flat during periods of heavy rain.

Game and Vermin

There has been an effort made to reduce the loss of foodstuffs caused by depredations by game and vermin. Hunting and netting of baboons, monkeys and pigs has been successfully accomplished in some districts. Possibly the greatest menace, however, is that of the field rats. Little damage was caused by these rats in the 1949/50 planting season but towards the end of 1950 it was obvious that they were going to amount to plague proportions in some areas. Early enquiries had failed to procure a supply of barium carbonate. Even in the United Kingdom it was stated that this was unobtainable. A stock of Rodine was obtained from the Overseas Food Corporation Disposal Section but this poison is not very suitable for field use and in any case the supply was very small.

Some good work was done in some Districts by means of locally made traps and some of the more energetic people have dug out the rats and killed them. Re-plantings of seed taken by rats has been done but as at the end of the year it is not possible to assess the reduction of planted crops that these rats may have caused.

Vermin destruction is one of the items included in the Southern Province Development Plan and it is hoped to have one European Crop Supervisor and a gang of African Instructors to concentrate on stimulating activities in destroying vermin of all kinds.

Mahiwa

The station and experimental work was placed under general charge of the Agricultural Officer, Lindi District, with a resident Agricultural Assistant responsible for the running of the station.

The experimental work is being revised but it is considered that its full value will not be attained until the proposed Botanist or Plant Breeder is resident on the station.

The rice experiments enjoyed a good season and included spacing and variety trials. Selection from an original number of 200 lines has reduced the number of distinctly useful types to seventeen. Hungarian rices have not been a successful introduction and the trial will not be repeated.

A contour block of paddy fields using a one-foot vertical interval was prepared. Yields of rice, from rainfall only, were encouraging.

Useful information has been obtained from the vegetable trial in which close observations were made on European vegetable varieties.

The dairy herd of twenty cows was introduced to test the possibilities of cattle keeping in a reputedly fly-infested area. The health of the herd was excellent throughout the year and fourteen calves were born. Milk yields were recorded : of these the best were :—

20 lb. per day in a 202 day lactation
25 lb. per day in a 113 day lactation
25 lb. per day in a 122 day lactation
20 lb. per day in a 83 day lactation

Other works carried out were clearing land for grazing improvement, fencing the farm boundaries, erection of new buildings and re-roofiing the old buildings. Mahiwa will figure in the Southern Province Development Plan. It is proposed to have a school for the increased intake of instructors before sending them into the field. The course will have a strong practical bias.

Overseas Food Corporation

Considerable revision of the plans for the development of the Nachingwea area of the Overseas Food Corporation took place during the year. Final decisions have not been made but the plan will undoubtedly be greatly reduced from its original conception. Their future plans will, it is believed, include continuation of experimental work which will be of great value. They will probably grow a variety of crops suitable to the varying soil types and it is satisfactory to note that their planting plans for 1951 are intended to include some 4,000 acres of maize. This would be an excellent contribution to Provincial and even Territorial grain supplies.

Development Schemes

The Southern Province Development Plan.—The production of this plan late in 1950 was probably the most important event which has occurred in the Province for many years. The plan is a simple one and aims at increasing

production both by natives and non-natives. In the first case the method by which it is hoped to achieve this is a very considerable increase in staff, both European and African, in the Department. Officers of the Provincial Administration with the Native Authorities will be very closely concerned with the implementation of the plan. Native Treasuries are also to make their contribution. In the case of non-natives it is proposed to open more areas for alienation. Development of communications, which up to the present have been notoriously poor, figures in the plan. This will include :—

(a) Completion of the railway from Ruo to Mtwara.

(b) The construction of deep water berths at Mtwara.

(c) Possible extensions of the Nachingwea line for some sixty miles westwards to Lumesule Juu.

(d) Re-alignment of some main roads.

(e) Improvement and construction of subsidiary roads from producing areas to the main road and to the railway.

It is not intended, however, to go into their plan in detail here. The main intention of the plan may be stated to be to raise the standard of economy within the Province and the means by which this is to be achieved are briefly :—

(a) To increase the output of the peasant.

(b) To alienate land as requisite for non-native development.

(c) Water development to enable to expand both native and non-native settlement.

It should be stressed that the primary object of the plan is not "to supply freight for the railway and ports".

The object is to develop communications which are essential to the progress of a new country and to use them to the full. Some aspects of development in the Province are given below.

Sisal.—There is an area near Nanganga adjacent to the railway which would seem to be suitable for sisal. Water supplies have yet to be proved.

Tobacco.—Land in the south-eastern area of the Songea District has been opened for alienation for the purpose of growing flue cured Virginia tobacco. The Tobacco Officer of the Department has been stationed in the area for some months, building and making necessary preparations for trials during the 1951 season. Forty 500-acre farms are available for immediate alienation and there is evidence of interest in these by some highly reputable firms.

The production of fire cured tobacco by members of the affiliated societies in Songea should increase steadily, and the opening of the new factory should enable the quantity produced to be efficiently handled.

A small start has been made to introduce fire cured tobacco in Tunduru and this is likely to expand when a Tobacco Officer is posted there. A European settler is negotiating for the alienation of a farm in the Tunduru District for the purpose of growing flue-cured Virginia tobacco.

Cashew Nuts.—The production of these has been increasing steadily and it is hoped that the time has come when non-native interests should convert this simple export crop into a dollar-earning crop by installing a processing factory. It is believed that there are people interested but no real plan has yet come to hand although the idea was first raised in September 1949.

Cassava, Starch and Flour Factory.—Although there is a firm interested and whose representative made preliminary investigations, even to selecting a suitable site, and possibly combining this with a plantation, nothing further has been heard of any real intention to start this.

Fish Ponds.—Little development of this has taken place as yet within the Province, although there are some sea fish ponds in Mikindani which have not been successful on account of too high a saline density on account of evaporation. Another trial is being carried out in the Lukuledi Estuary, where possibly there is a better chance of success on account of the flow of fresh water from the Lukuledi River.

There are plans in the making to utilize inland lakes for fish farming and the provision of protein food for the people of the Province is an essential part of the Development Plan.

It is hoped that the Fisheries Officer will visit the Province during 1951 in order to advise on the possibilities.

Mechanical Cultivation

(a) *Ruvuma.*—A pilot scheme was commenced in the Ruvuma River area during the year. Two Massey-Harris Perkins diesel tractors and two ploughs were purchased from a loan provided by the Newala Native Treasury. The equipment did not arrive in Mikindani until mid-September—but ploughing was commenced before the end of that month. Approximately 600 acres were ploughed, about 300 in Mikindani and 300 in Newala. The best ploughing was in the Mikindani area as the Newala area was covered with tall thick grass which did not burn easily and the soil was heavier. Some damage was sustained by striking stumps. It was found difficult to get the people to perform their part of the work to ensure that all such snags should be removed.

(b) Other.—It may be that the Development Plan may include a Departmental Grain Production Unit. This, however, will have to be approached with caution. A great deal of the Province is marginal for maize except in valleys and mechanical cultivation of sorghum is still in the experimental stage.

Pests and Diseases

There are no reports of any severe incidence of pests and diseases during the year.

District Reports

Some brief notes relating to Districts are given below :—

(a) *Songea.*—There was a record tobacco crop, also a good deal of sunflower seed produced. The tendency in Songea has been to become unbalanced in production to the detriment of food production, and it was found difficult to procure sufficient food to meet the requirements of employers of labour.

(b) *Tunduru.*—The rains ceased early and suddenly and they had a poor year for food; towards the end of the year there were local food shortages acute in one area. The fact that food shortages existed at all in this District or any other is entirely due to the neglect to plant the requisite plot of cassava every year. Sunflower seed and tobacco growing are increasing in popularity.

(c) *Masasi.*—This District suffered to some extent from changes of staff. No severe food shortages were reported and at the end of the year the District Commissioner carried out a very vigorous planting drive. The first steps in the implementation of the Development Plan.

(d) *Newala.*—This was a poor year for production of food-stuffs. There was also a serious decline in cassava production. Newala has been known in the past as the "granary of the Southern Province". It is believed that fertility is declining seriously on account of the period of cultivation being increased, and the period of bush decreased. It is hoped that the projected water development plans will be designed to scatter the population and so rectify matters to some extent.

(e) *Mikindani.*—Floods on the Ruvuma destroyed a great deal of rice. The floods were exceptionally high, however, and it is hoped that the ploughed areas will not suffer from excessive flooding in 1951. According to local reports excessive floods only occur about once in every twelve years. Food production was not very satisfactory in 1950.

(f) *Ruponda.*—This District made an increased contribution to food supplies during 1950. No food shortages have been reported.

(g) *Kilwa.*—A good contribution of padi was made by this district. 1,460 tons have passed through markets out of a total for the Province of 2,783 tons. No food shortages are reported. Ploughing units of the Rufiji Scheme have again ploughed a further 100 acres for the 1951 season.

(h) *Lindi.*—Lindi had a fairly satisfactory season and showed the higest market figures of any District for the production of maize and sorghum.

World Agricultural Census

The census was carried out as well as could be by frequent changes in staff and a number of rather poorly educated instructors. It has been useful in as much as it has shown how small the average plots are and how obvious it is that the local cultivators aim at the barest subsistence level in staple foodstuffs.

Summary

A disappointing year in many ways. This Province which in the past has been regarded as safe to produce all its food requirements and often a surplus to help to relieve shortages elsewhere in the Territory has had to import food. Admittedly, the rainfall conditions were not fully satisfactory, but the real reason is quite simple. The cultivator did not plant enough and showed an increasing tendency to rely on money. This state of affairs must be remedied as the first essential step in implementing the Development Plan.

Acknowledgments

It is a pleasure to record appreciation of the strong interest in all agricultural work by the Provincial Commissioner and District Commissioners. Some of the latter who have no officers from this Department in their District deserve thanks for all they have done in controlling the activities of the instructors and dealing with their pay and personal matters.

To all, thanks are due for their co-operation and hospitality.

H. L. Brett,
Provincial Agricultural Officer, Southern Province.

APPENDICES

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"C" Export Figures 166

SOUTHERN PROVINCE

PROVINCIAL PRODUCE MARKET RETURNS

1948, 1949 and 1950

DISTRICT	MTAMA			MAIZE			PULSES (Including Bambarra Nuts)			RICE AND PADDY			CASSAVA			GROUNDNUTS			SESAME		
	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950
Lindi	1,342	2,353	2,654½	168	732	1,805	675	1,457	520	75	101	779	2,022	358	147½	69	131	52½	2,144	454	660
Newala	474	2,394	551	735	1,344½	561½	150	530	137	397	102	174	12,262	4,110½	1,001	64	156	32	127	138	57
Masasi	154	218	141	166	509	271	809	529	183	61	36	49	1,114	673	35	499	550	1,003	407	273	151
Tunduru	1	10	3	17	438	81	-	172	–	307	301	69	—	—	—	163	215	127	81	111	18
Mikindani	395	387	202	109	251	716	103	209	1,405	-	41	183	3,036	690½	4	7	—	2½	186	91	178
Kilwa	719	1,071½	801	21	97	407	70	177	35	438	587	1,460	—	2	—	1	—	-	792	449	463
Songea	–	–	–	–	67	80	17	30½	4½	129	121½	53½	185	205½	63½	23	14½	34	79	101	9
Ruponda	–	147½	679	–	2	243	–	23½	48½	–	2	16	—	1½	1	—	19	8	-	93½	204
Total Tons	3,085	6,581	5,031½	1,216	3,440½	4,164½	1,824	3,128	2,333	1,407	1,291½	2,783½	18,619	6,041	1,252	826	1,085½	1,259	3,816	1,710½	1,740
Exports—Tons ...	1,378	250	115	307	66	551	662	53	63	47	–	624	14,052	5,861	96	454	168	21	2,209	1,198	1,387

DISTRICT	MILLET			CASHEW NUTS			GUM			BEESWAX			COLOMBO ROOT			CASTOR SEED			SUNFLOWER		
	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950	1948	1949	1950
Lindi	16	15	22½	553	828½	2,776	—	—	285	16	2½	2½	—	86	151	22	33½	147	—	—	7
Newala	232	518	382	110	675½	648	—	—	—	6	4	1½	—	—	—	—	—	1	—	—	13
Masasi	—	95	14	—	308	1,268	—	—	—	—	—	1	—	—	—	—	1½	2½	—	—	11
Tunduru	—	19	7	—	—	—	—	—	—	—	—	—	—	—	—	—	16½	—	-	—	116½
Mikindani	139	3	17	219	260	1,085	—	—	—	—	—	½	—	—	—	—	½	—	-	—	½
Kilwa	—	½	3	—	—	252	—	21	1,942	—	½	1¾	-	—	—	-	—	—	-	—	2½
Songea	—	—	6	—	—	—	—	—	—	—	24½	6¼	—	—	—	-	-	-	-	—	22
Ruponda	—	—	7	—	1½	—	—	—	—	—	—	1¼	—	6	28	-	-	½	-	—	3
Total Tons	387	650½	458½	882	2,073½	5,029	—	21	2,227	22	31½	15	—	92	179	22	54	151	—	—	175½
Exports—Tons ...	119	220	126	4,533*	3,276	4,787	66	28	25	164	174	86	25	227	124	19	62	94	—	—	1,259

*Cashew Nuts produced by non-native enterprise.

Appendix "B"

PRODUCE PURCHASED BY GRAIN STORAGE DEPARTMENT

(Including produce bought by estates on permit) 1950

PRODUCT	TONS
Maize	3,358
Cassava	392
Rice	715
Sesame	21
Millets	422
Wheat	203
Edible Oils	7
Sorghums	2,338
Groundnuts	42

Appendix "C"

SOUTHERN PROVINCE

EXPORTS FROM LINDI, MIKINDANI AND KILWA—IN TONS

PRODUCT	1949	1950
Groundnuts	168·22	21·00
Sesame	1,196·24	1,387·00
Mtama	249·64	115·00
Maize	66·20	551·00
Pulses	52·68	63·00
Cashew Nuts	3,275·54	4,787·00
Beeswax	174·04	86·00
Tobacco	194·03	185·00
Cassava	5,860·63	96·00
Wild Rubber	—	—
Gum	27·81	25·00
Mangrove Bark ...	1,296·00	750·00
Colombo Root ...	226·63	124·00
Native Starch... ...	13·90	2·00
Copra	1,379·31	735·00
Other Grain	—	—
Millet	220·08	126·00
Rice	—	624·00
Sisal and Tow. ...	11,389·00	9,983·00
Castor Seed	61·45	94·00
Cotton (Lint)	54·78	30·00
Sunflower	578·29	1,259·00
Garlic	—	3·00
Kapok	—	3·00
Kapok Seeds ...	—	16·00
Copra Oil Cake ...	—	51·00
Tobacco Coil	—	15·00

1950 ANNUAL REPORT OF THE PLANT PATHOLOGIST, LYAMUNGU, MOSHI

Staff.—The Plant Pathologist and the Temporary Scientific Assistant (Mrs. M. M. Wallace) were on duty throughout the year, with local leave from 31st July to 11th August.

Acknowledgments.—Grateful acknowledgment is made for identifications of fungi and bacteria made by the Director and staff of the Commonwealth Mycological Institute, Kew; Dr. W. J. Dowson, the Botany School, Cambridge; and Dr. W. L. Gordon, Department of Agriculture, Canada.

Many officers of the Department of Agriculture have sent in plant material for diagnoses, and have collaborated closely in many ways. The Temporary Scientific Assistant has been directly associated with all work and publications of the laboratory.

Touring.—The Plant Pathologist was on tour for 103 nights. From 23rd January to 11th February he visited Southern Rhodesia where he was accompanied to farms and Experiment Stations by Dr. J. C. F. Hopkins, Chief Botanist and Plant Pathologist, and other members of the Department of Agriculture and Lands. This visit was of the utmost value and the Plant Pathologist is glad to acknowledge the kindness and helpfulness of all with whom he made contact.

The Southern Highlands Province was visited on three occasions, the last being chiefly in connection with the staging of the plant pathology exhibit at the Natural Resources Show at Mbeya.

The Temporary Scientific Assistant visited the Sisal Research Station, Mlingano, on three occasions, sisal estates in the Tanga Province and near Lindi, and also estates at Lushoto.

Publications.—Five Mycological Circulars were published during the year; of these Nos. 25, 26 and 29 are in the "Recent Records" series; No. 27 is entitled "The inoculation of leguminous seeds", and No. 28 "Pink ear rot of maize". An article on Mosaic of French beans was published in the *Tanganyika European Council Bulletin*. Two papers on diseases of sisal have been accepted for publication in the forthcoming *Journal of the Tanganyika Sisal Growers' Association.*

Visitors.—Among visitors to the laboratory were Dr. Norman Wright, Chairman of the Colonial Research Council; Señor Ruy Miler Paiva and Señor O. T. Mendes Sobrinho, members of the visiting Brazilian Agricultural Commission; Sir Charles Dundas; G. B. Surridge, Esq., Co-operative Adviser, Colonial Office; D. Akenhead, Esq., Director of the Commonwealth Bureau of Horticulture; Dr. A. J. Page, Principal of Imperial College of Tropical Agriculture, Trinidad; The Hon. the Director of Agriculture and the Deputy Director of Agriculture, Dar es Salaam; Dr. D. Rudd Jones, Plant Pathologist, E.A.A. and F.R.O.; J. B. S. Hemingway, Esq., and P. K. S.

Clinton, Plant Pathologists, Overseas Food Corporation; H. C. Thorpe, Esq., Senior Plant Breeder, Kenya, and A. B. Cormack, Esq., Provincial Agricultural Officer, Nyasaland.

Laboratory work.—Over 250 specimens of diseased plants have been examined; these included thirty-one new records of plant diseases for Tanganyika. Those of any significance have been discussed in the Mycological Circulars referred to above, and it is only necessary in this report to list a number and deal more fully with those which have been investigated.

Germination tests have been made on a number of samples of farm seeds. Cultures of nodule bacteria for inoculating leguminous seeds have been supplied to farmers on request. During the past two years samples of soils have been sent monthly to Messrs. I. C. (Pharmaceuticals) Ltd., Manchester, to assist them in their search for moulds with antibiotic properties. The laboratory staff have collaborated with the Plant Pathologists of the Overseas Food Corporation in Tanganyika on a number of problems, assisting chiefly in the identification of plant diseases and pathogens.

The number of plant diseases now recorded in Tanganyika is about 730. These have been listed in Mycological Paper No. 26 of the Commonwealth Mycological Institute, Kew, and local Mycological Circulars and Annual Reports of 1949 and 1950. Further records will be announced in Mycological Circulars. Mycologists are thus kept up-to-date with the plant disease position in this Territory. The reason for the constant addition is very much more a result of intensified and wider observation than of pathogens entering the Territory in planting material. A few records result from the introduction of plants susceptible to organisms already existing but not recorded, either in the soil or on indigenous host plants. The ability of fungi to mutate and adapt themselves to plants previously immune sometimes accounts for new records, for example among the rust fungi and the potato blight fungus.

Plant Diseases

Barley.—Loose smut was found on a few farms, and had presumably come in with seed.

Beans.—Halo blight of French beans was seen on three farms. Anthracnose was very destructive on one. Mosaic was much more common than usual. Yeast spot, *Nematospora coryli*, was likewise very common.

Camphor, Ocotea usambarensis.—Two fungi from wood with a purplish stain are being studied.

Coffee.—'Black bean' was common in the 1950 crop of Arabica coffee at Lyamungu. The beans may be merely spotted or be completely blackened with a wrinkled surface. The 'silver skin' remains firmly attached over the discoloured areas and retains its cellular structure. The endosperm is discoloured and there is a slight shrinkage of the tissues, although the outer layers of cells are collapsed or rotted. Two bacteria from spotted beans were

isolated but produced no sign of infection when inoculated into green cherries. It is possible that the trouble may be the same as that described by W. W. Mayne in India and referred to him as "Black jeloo".

Cypress.—A mild form of Cypress canker, *Monochaetia unicornis*, has been observed near Tukuyu by Dr. D. Rudd Jones, Plant Pathologist of E.A.A. and F.R.O. The disease still persists in the Usambaras.

Geranium, Pelargonium capitatum. In rather woody plants being grown for oil two root diseases were present: *Armillaria* root rot and Violet root rot. As the perfect *Helicobasidium* stage of the latter was not seen, the identity of the fungus is uncertain, but it is provisionally named *H. purpureum*. Previous drought is thought to have weakened the plants and rendered them susceptible to this fungus.

Lucerne.—A plot of lucerne near Moshi sufferd severely from Anthracnose, *Colletotrichum trifolii*. Rust, *Uromyces striatus*, was also severe in the Moshi district.

Maize.—A disease which has caused much loss of crop this year is Pink ear rot. The fungi concerned are *Fusarium graminearum*, *F. moniliforme*, and *F. moniliforme* var. *subglutinans*. *Cephalosporium acremonium* which can cause Black bundle disease was associated with di-coloured seed in two districts.

Mvule, Chlorophora excelsa.—One year-old trees in a forest nursery near Moshi were being rapidly killed out by Violet root rot. The perfect stage of the fungus, *Helicobasidium compactum*, was seen on one plant. The disease was associated with a high water-table and consequent sodden condition of the soil. Large trees of the same species were being killed by the root parasite *Fomes noxius*.

Poppy, Papaver rhoeas.—A bacterial disease of Shirley poppies has been investigated. The causal bacterium was isolated and its pathogenicity proved. Dr. W. J. Dowson, Cambridge, to whom a culture was sent believes it to be a new species, and with his collaboration the disease and pathogen will be described.

Potato.—The virus disease Rugose mosaic was observed on one farm by Mr. J. K. Robertson, Provincial Agricultural Officer. The disease had apparently come in with the seed; the crop was disposed of by consumption locally.

Tubers of potatoes with immunity to Irish blight forms are still being received for trial at Lushoto, through the kindness of Dr. W. Black, Geneticist of the Scottish Society for Plant Breeding.

Pyrethrum.—Bud disease, with which *Ramularia bellunesis* is associated, was found in the Northern Province; it had been known in the Southern Highlands Province. In the latter Province *Coniothyrium* sp. was also present causing disease of buds and flowers. Cutting trials in connection with disease are being continued on a farm at Uwemba. *Sclerotinia sclerotiorum* was isolated from wilting plants in the same area.

Sisal.—An investigation was made into the subject of bole rots of sisal. The fungus *Aspergillus niger* was isolated from infected boles and artificially inoculated into healthy young rooted bulbils. Under certain conditions, namely a damp atmosphere and the presence of wounds, a soft wet rot was set up. These results were so definite that it was considered advisable to carry out inoculation experiments on a field scale using mature sisal. This was done at Mlingano by the Sisal Research Station staff. The results show that *A. niger*, inoculated into cut leaf stumps of two and a half year old sisal, initiated the typical wet rot in eighty-six per cent of the plants. The question of how far *A. niger* is by itself responsible for wet bole rot of sisal has yet to be decided. It is thought that the progress of the rot inside the plants may be linked up with some chemical deficiency, e.g. calcium.

A form of dry rot, designated Basal dry rot from the fact that infection occurs at the base of the bole below soil level, was shown to be also associated with *A. niger*, which apparently enters the plant tissues through wounds.

What may be a third type of bole rot seen in the Southern Province, is still under investigation.

Sorghum.—Seed treatment trials against Grain and Loose smuts are being continued with the collaboration of other officers of the Department. The only results to hand are from the Central Province, where the best control was given by sulphur dust, followed by Nomersan and T.M.T.D., but conclusions cannot yet be arrived at.

Strawberry.—The virus disease Crinkle in its mild form has been seen on one occasion. The leaf-spot caused by *Dendrophoma obscurans* was also seen in one garden.

Sunflower.—Leaf diseases were destructive this year, e.g. *Helminthosporium helianthi* at Morogoro and Rust, *Puccinia helianthi*, in the Northern Province.

Tobacco.—*Nicotiana rustica*, which is grown in the Southern Highlands Province for nicotine has a common leaf-spot. A bacterium isolated from such has been identified provisionally as *Pseudomonas mellea* by Dr. W. J. Dowson. The virus disease Kromnek is now found in *N. tabacum* on many farms in the Iringa district: removing affected plants early is found to be effective in the control of spread. No other host plants of this virus have been observed in the Territory. Mosaic and Leaf-curl continue to be destructive.

Tomato.—Typical Magnesium deficiency was seen on a farm in the Moshi district.

Tree tomato.—An unusual virus disease of this tree has been in the Southern Highlands and Northern Provinces and is being investigated.

Wheat.—*Fusarium oxysporum* was isolated from unthrifty wheat seedlings. It is suggested that the condition resulted from unsuitable patches of soil, as *F. oxysporum* is not thought to be actively parasitic in cereals. A damaging foot-root of seedlings and leaf-spotting of older plants have been caused by *Helminthosporium sativum*.

Seventeen samples of Stem rust were tested for determination of the strains present. The new form K9 was predominant, appearing in thirteen samples. The only other form definitely identified was K1. The wheats Kenya Settler (294.M.7.C.I.C.) and 294.M.7.C.6.A. were badly rusted at Oldeani, both K1 and K9 being revealed in the tests. Kenya Settler is apparently field-susceptible to K1 in Tanganyika although in Kenya it is stated to show seedling resistance.

New Records

Aecidium crini Kalch. on *Crinum* sp.

Alternaria carthami Chowdhury on *Carthamus tinctorius*

— *?gossypina* (Thum.) Hopkins on *Hibiscus ?cannabinus*

Ascochyta abelmoschi Harter on *Hibiscus rosa-sinensis*

Aspergillus luchuensis Inui from soil

Cephalosporium acremonium Corda on Maize

Cicinnobolus cesatii de Bary parasitic on mildew

Coniothyrium sp. on Pyrethrum

Colletotrichum trifolii Bain & Essary on Lucerne.

Dendrophoma obscurans (Ell. & Everh.) Anderson on Strawberry

Fusarium oxysporum Schl. isolated from Wheat and Clarkia

— — — f. *dianthi* (Prill. & Del.) Hansen on Dianthus

Gibberella fujikuroi (Saw.) Wollenw. var. *subglutinans* Edwards on Maize

Helicobasidium compactum Boedijn on *Chlorophora excelsa*

Helminthosporium helianthi Hansf. on Sunflower

— sp. on Salvia leucantha

Mycosphaerella rosigena (Ell. & Everh.) Stevens & Roldan var. *madagascariensis* (Bouriquet) comb. nov. on Rose

Penicillium corymbiferum Westling from soil

— *purpurogenum* Stoll from soil

Pestalotia mangiferae P. Henn. on Mango

Phyllachora caffra Syd. on *Cordia holstii*

Phyllosticta antirrhini Syd. on Antirrhinum

— *hibiscina* Ell. & Everh. on *Hibiscus rosa-sinensis*

?Pseudomonas mellea (Johnson) Stapp on Tobacco (*N. rustica*)

— sp. on *Papaver rhoeas*

Puccinia antirrhini Diet. & Holw. on Antirrhinum
Septoria antirrhini Desm. on Antirrhinum
— *helianthi* Ell. & Kell. on Sunflower
Sphaceloma rosarum (Passer.) Jenkins on Rose
Stagonospora curtesii (Berk.) Sacc. on Daffodil
Uromyces mucunae Rabh. on *Mucuna aterrima*
Ustilago nuda (Jens.) Rostr. on Barley

New Hosts for Fungi already recorded

Barbarton daisy : *Alternaria macrospora* Zimm.
Bean, Runner : *Cercospora cruenta* Sacc.
— — *Uromyces appendiculatus* (Pers.) Link
Cauliflower : *Glomerella cingulata* (Stonem.) Spauld. & Schrenk, in conidial stage
— : *Peronospora parasitica* (Pers. ex Fr.) Tul.
Cestrum elegans: Glomerella cingulata in conidial stage.
Chlorophora excelsa ('Mvue') : *Formes noxius* Corner
Echium sp. : *Pleospora herbarum* Pers. ex. Fr.
Groundnut : *Macrophomina phaseoli* (Maubl.) Ashby
Guinea grass : *Cercospora fusimaculans* Atk.
Hibiscus ?cannabinus: Cercospora hibisci Tracy & Earle
Kudzu bean *(Pueraria hirsuta): Cercospora canescens* Ell. & Martin
— — — — — : *Glomerella* cingulata in conidial stage
Lespedeza : *Corticium solani* (Prill. & Delacr.) Bourd. & Galz.
Pelargonium capitatum: Armillaria mellea (Fr.) Quél.
— — : *Helicobasidium ?purpureum* Pat. Rhizoctonia stage
Pennisetum salifex: Beniowskia sphaeroidea (Kalchbr. & Cooke) Mason
Salvia farinosa:Erysiphe polygoni DC.
Sunn Hemp : *Nematospora coryli* Pegl.
Sunflower : Leveillula taurica (Lév.) Salm.
Teak : *Armillaria mellea* (Fr.) Quél.
Tuberose : *Botrytis cinerea* Pers. ex. Fr.
Yam : *Armillaria mellea* (Fr.) Quél.

New Record of Virus Diseases

Potato : Rugose mosaic
Strawberry : Mild form of Crinkle
Tree Tomato : Virus disease of the Mosaic type

Deficiency Disease

Tomato : Magnesium deficiency.

G. B. Wallace,
Plant Pathologist

ANNUAL REPORT OF THE ENTOMOLOGIST LYAMUNGU, FOR THE YEAR 1950

Crops and Pests

Coffee.—The *White Coffee Borer (Anthores leuconotus* Pasc.) has continued to cause concern particularly in the Northern Province. A survey has shown that practically all coffee below an altitude limit ranging from 4,400—4,000 feet at Kirua, 4,350 feet at Mweka, 4,100 feet at Lyamungu, 3,800 feet at Machame, 4,500 feet (approx.) at Sanya Juu is infected with borer to a varying degree. Most of the lowest coffee is so badly bored as to be useless. There is every reason to suppose that this upper limit is not fixed and that the pest is climbing to higher altitudes. One plot of coffee in a lower estate was found to have an average of 11·2 larvæ per tree or about 6,000 larvæ per acre, and since the life cycle lasts two years about 3,000 adults per acre can be expected to emerge from the trees annually.

Experiments to control borer by chemical means have continued. It was found that the egg having been laid under the bark is sealed off from the outside by a chitinous plug which is insoluble in non-phytotoxic solvents and since solvents do not penetrate the bark without destroying living tissue, experiments to destroy the egg have been abandoned. Experiments to kill ring-barking larvæ by applying insecticides in kerosene to the stem were successful but it has since been found that the kerosene destroys most of the cork cambium and some of the underlying phloem. The phosphorus insecticide, paranitrophenyl-diethyl-thiophosphate (a proprietary formulation used at an unusually high concentration had no effect on ring-barking or boring larvæ nor did the systemic insecticide bis (bis dimethylamine phosphorus) anhydride (a proprietary formulation). Some success was achieved in killing the adults and future investigations will be followed on this line. See *East African Agricultural Journal* Vol. XVI No. 3.

Data on the life history and bionomics of the pest have been collected.

Leaf-miner (Leucoptera coffeella Guer.) has been a serious pest at some localities, particularly on some unshaded plants at the Coffee Research Station and nearby estates. The dominant stage as previously described by F. B. Notley was most marked.

Antestia *(A. lineaticollis* Stal.) can no longer be regarded a serious pest since D.D.T. has continued to control the pest well.

Pseudococcus filamentosus Ckll & *P. virgatus* Ckll have been active at the Coffee Research Station and on estates.

Tachardina brachystegiae, Hall. a scale insect found on coffee at Oldeani, has not previously been recorded on coffee in East Africa.

Green scale (Coccus africanus Newst) is locally a very serious pest of coffee and has been responsible for killing young coffee at Arusha and Sanya

Juu. Experiments to prevent the ants from reaching the scale using a benzene hexachloride dust have been unsuccessful. Grease banding is effective for a short time only.

Sisal

It has been found that a 0·2 per cent paranitrophenyl-dethyl-thiophosphate (used as a proprietary product) gives some control over the Sisal Weevil (*Scyphophorus acupunctatus* Gyll.) in young sisal plants.

Peas

Two species of caterpillar identified as *Prodenia litura* F. and *Laphygma exigua* Hb, caused very serious damage to peas. The first and second instar larvæ live in folded leaves at the apex of the plant and in the flowers and feed on the delicate growing tissues. The large caterpillars feed on mature foliage and many enter the pods to feed on the seeds. A benzene hexachloride dust containing 0·65 per cent gamma B.H.C. applied at about sixty lb. per acre failed to give adequate control.

Preliminary trials suggest that a D.D.T. spray will control the pest.

Beans

Four parasites of *Agromyza phaseoli* (other bean fly) have been identified as *Trigonogastra* sp., *Eulophid* ? Gen., *Gronotoma* sp.n., and *Opius* sp.

Tomatoes

Commercially grown tomatoes have suffered from a "tomato fruit worm" (an unidentified noctuid caterpillar) which enters the fruit and causes it to rot. Tomato mite and eelworm are also causing concern.

Tea Seed

Caterpillars which feed and pupate within tea seed have been identified as *Auximbasis glandulla* Riley (a new record for the world) and *Argyroploce leucotreta* Meyr.

Eucalyptus citriodora.—A weevil causing defoliation in the Mwanza district has been identified as *Nematocerus castaneipennis* Hust.

Maize

Stem borer was particularly serious in the main crop of one estate where previously a short rains crop was taken. Farmers should protect themselves by not growing maize in the short rains.

Wheat

Cydnus sp. nr. *horridus* Sign. has caused considerable destruction to wheat in Oldeani. Laboratory trials have shown that 1·4 lb. of technical benzene hexachloride per acre distributed in soil can cause distorted growth of wheat seedlings.

Other Insect Pests

Hyperaspis jocosa has been bred in the laboratory and liberated in the field to combat *Orthesia insignis Dougl*, a scale pest of Jacaranda trees, forestry nurseries, ornamental plants, and occasionally arabica and robusta coffee.

H. Jocosa, a ladybird and predator of *O. insignis* is indigenous in Honolulu Hawaii and was imported into Tanganyika via Kenya.

Grasshoppers

A new species of grasshopper *(Tettigoniidae)* as yet undescribed was reported to be causing extensive damage to native grain crops at Rukwa.

Homorocoryphus vicinus Walk and *Cyrtacanthacris tatarica* L. have been reported as being in large numbers from Lake Eyasi.

R. G. Tapley,
Entomologist.

1950 ANNUAL REPORT OF THE ENTOMOLOGIST, MOROGORO

Staff

I have been stationed throughout the year at Morogoro. A total of 122 nights have been spent on safari, tours having been made in the Lake, Northern, Eastern and Central Provinces. African laboratory staff have visited the Lake and Western Provinces.

Cotton Pests

Both in the Lake and Eastern Provinces much damage was caused by the larvae of the American Bollworm, *Heliothis armigera*, Hb., the adults breeding up on maize which was extensively planted this year and migrating on to the cotton at its most attractive stage. In the Eastern Province some crops were totally destroyed by this pest. A small insecticide trial near Kilosa, in collaboration with the officers of the Empire Cotton Growing Corporation, using a dust containing five per cent D.D.T. plus three per cent gamma B.H.C. indicated the potential value of such treatments. The yields from the plots were too low owing to late planting to allow of firm deductions being made .

In the Eastern Province Spiny Bollworm, *Earias* spp., appeared in large numbers after *Heliothis* preventing fresh attempts by the plants to set a crop. Of the stainers *Dysdercus intermedius*, Dist. and *Dysdercus nigrofasciatus*, St. were locally abundant in June and July, whilst *Dysdercus fasciatus*, Sign. appeared only after the cotton had fully opened. The general picture was one of little staining. Slight damage was caused by *Helopeltis bergrothi*, Reut and some stem weevils, *Apion xanthostyllum*, Wagn., were

found locally towards the end of the season. Cotton in the Lake Province was heavily attacked by Jassid, *Empoasca fascialis*, Jac.; local variety suffered badly but resistant varieties developed at Ukiriguru Experiment Station showed up to advantage.

Plantation Crops

Sugar cane being grown as a new venture in Bukoba was severely attacked by the Dynastid beetle, *Heteronychus tenuestriatus*, Farm. A survey made in August revealed that the insect was indigenous to the swamp lands in which the plantation was being developed. So far the adult insect, which causes damage by boring into the setts and destroying the buds, has proved very resistant to chemical control: the larval stages are readily controlled by raking Gammexane dust into the soil.

In the Iringa district tobacco eelworm, *Heterodera marioni*, and tobacco cutworm, *Euxoa segetum*, Schiff. were again troublesome pests whilst one plantation of peas was virtually destroyed by larvæ of *Heliothis armigera*, Hb. and *Prodenia litura*, F. Peas in the Arusha district also were heavily attacked by *Heliothis* larvae.

Onion thrips, *Thrips tabaci*, Lind., did local damage in the Kilosa and Saranda districts.

Plant sanitation measures against the Coconut beetle, *Oryctes monoceros*, Ol. have been actively continued in the coastal regions but heavy infestations can still be found in buried trunks and remains of stumps. A brief search for parasites revealed small numbers of the Scolid wasp, *Scolia rufocornis*, F., around Morogoro and Mwanza: no parasites were obtained after a survey in the Bagamoyo district. The Reduviid bug, *Platymeris laevicollis*, St., was reported as causing the fall of young nuts on Mafia Island and the adjacent coastal area.

Short term sorghums grown out of the normal season near Lushoto were heavily damaged by the larvæ of the sorghum stem maggot, *Atherigona indica*, Mall., the degree of damage being directly correlated with the lateness of planting. Larvæ of the Chloropid flies *Scolioplatalamus accantipennis*, Duda., and *S. obliquus*, Beck. were found in sorghums infested by *Atherigona* in Morogoro.

Native Crops

Widespread outbreaks of Army worm *Laphygma exempta*, Wlk., were recorded early in the year from the Lake, Northern, Central and Eastern Provinces. Near Morogoro dusting with two-and-a-half per cent D.D.T. achieved prompt control. Heavy infestation of the borer *Busseola fusca*, Hmpsn. were recorded on maize from the higher areas of the Njombe District and in sorghums in the Unyamwezi and Kibondo areas of Western Province. A late season attack on sorghums in the Lake Province by this pest fortunately did little real damage. The Galerucid beetle *Megalognatha suturallis* was reported attacking the tassels of early maize in the Morogoro District.

Cassava Scale, *Aonidiomytilus albus*, Ckll., spread further throughout the Lake Province and was later reported from Tabora in the Western Province and Mpwapwa in the Central Province. The damage from this insect appears to have dimininshed in the Lake Province as a result of propaganda by the Department to plant clean material only. Elegant grasshopper *Zonocerus elegans*, Thng., appeared in large numbers generally; locally this pest completely defoliated cassava plants and ate off the bark but the majority of these plants recovered after the onset of the main rains.

Kunde in Morogoro district and beans in the Tabora area were damaged by the adults of the Galenicid *Ootheca bennigsenni* Wse. Experience at Kingolwira showed that this insect is readily controlled by D.D.T. or B.H.C. dusts. *Heliothis armigera*, Hb., caused considerable damage to young fruits of chickpea in the south and east Lake area, and to linseed pods in Irambo, Southern Highlands Province.

Grain storage

Organised grain storage in the Territory is carried out by the Department of Grain Storage and by Native Authorities. The former stores in bags in large godowns at various strategic centres and the latter in bulk in circular brick silos of approximately fifty tons capacity. In both types of store it has been established that process of thermal self-sterilisation occurs resulting in a purely peripheral concentration of insects. Excellent control of the rice weevil, *Calandra oryzae* L., was achieved in Central Province silos, where the grain is mostly millets mixed with sorghum, by admixing Gammexane at the rate of 0·5 pts. per million with the top and bottom layers of grain only. *Tribolium castaneum*, Herbst., was not controlled at this dosage. In the bags stores experiments in which the grain in the peripheral bags only is being mixed with Gammexane at 0·5 pts. per million combined with the external dusting of all bags with 0·5 per cent gamma B.H.C. are in progress.

Tests on one of the three grain driers purchased by the Department of Grain Storage were made in October from which it was concluded that efficient drying and disinfestation of maize could be done for a cost of approximately twenty-five cents per 100 kilo sack.

Miscellaneous Insects

The Kagera Dwarf Locust, *Faureia milanjica*, Karasch, appeared in swarms in Bukoba in early January, subsequently spreading south to Biharamulo where it was observed breeding towards the end of the year: nymphs were received from that district in December. Damage to crops was negligible although eleusine was attacked in the Bukoba area by the migrating swarms.

Constructional timbers in Dar es Salaam were found to be infested by a number of species of yet unidentified Bostrichid borers and D.D.T. spraying has been carried out as a control. The final results of the control measures are not yet known.

A heavy infestation of roses in Morogoro by the mealybug *Icerys aegyptiaca*, Dougl., was brought under control by a combination of D.D.T. oil emulsion spraying and severe pruning. This mealybug is attended in large numbers by the ant *Anoplolepis custodiens*, Smith, but so far the precise relationship has not been worked out. The Lantana bug, *Orthezia insignis*, Dougl., appeared on ornamental shrubs in Mwanza.

Citrus seedlings in Morogoro were attacked by the Psyllid, *Trioza erythracae*, DeG., and by the citrus aphid *Toxoptera aurantii*, Bay. D.D.T./ oil emulsion spraying and severe pruning. This mealybug is attended in a spray at twice the recommended concentration proved very good against the aphid. Parathion at 0·005 per cent strength did not control *Toxoptera*.

The grey field mouse *Mastomys coucha*, which appears in "plagues" approximately every seven years, caused extensive damage to cotton in the late season in Morogoro and Kilosa districts, subsequently invading native grain stores and finally feeding on planted grain seeds and on seedlings towards the end of the year.

Extension Work

An exhibit on Grain Storage was staged for the Southern Highlands show at Mbeya in September.

Publications

"The Biology and Control of the Cassava Scale".

East African Agricultural Journal XVI No. 2.

Additions to the list of Injurious Insects

Dinoderus distinctus, Lesne.

Bostrichidae—stored cassava.

Tarchardina brachystegiae, Hall,

Coccidae—coffee.

Heteronyehus tenuestriatus, Fairm. Dynastidae—Sugar cane.

Platymeria laevicollio, St. Reduviidae—coconut.

Nematocera castaneipennis, Hust.—eucalyptus.

Acknowledgments

Thanks are again due to the Director, Commonwealth Institute of Entomology for identifications and to the Empire Cotton Growing Corporation for information on cotton pests.

G. Swaine,
Entomologist

ANNUAL REPORT OF THE FISHERIES OFFICER (INLAND FISHERIES) KIGOMA

General

The approved capital projects are within sight of completion. The new Fisheries Office and Laboratory at Kigoma was occupied in September. The 14ft. 9ins. dinghy, powered by outboard motor, was received at the end of the year. The hull of the 45ft. Motor Fishing Vessel, which was built in Durban, has arrived at Kigoma and the engines, on order in the U.K., should follow shortly. Final construction of the vessel is being undertaken by the East African Railways workshops at Kigoma and it is hoped that it will be ready for sea when the Fisheries Officer returns in mid-1951.

Work during the year has been primarily concentrated on Lake Tanganyika, with especial reference to the valuable dagaa fishery. The greater part of the lake shore is accessible only by water and, lacking full-time water transport, work has of necessity been mainly confined to Kigoma District. Investigation of the fisheries of the Malagarasi system has continued; supervision of Lake Rukwa has been maintained and work has been carried out on a number of minor waters.

There is a growing interest in freshwater fisheries throughout the Territory and many requests for advice have been dealt with during the year. The present strength of the Department's Inland Fisheries organisation has not made it possible to accede to many requests for direct assistance in stocking dams, etc. Technical assistance has been given in the preparation of the new Fisheries Ordinance, a very comprehensive piece of legislation which should do much to aid in the control and development of the Territory's fisheries.

No formal conference or committee meetings were attended this year but informal contact has been maintained with the fisheries authorities of several neighbouring territories. In July, Mr. Lockley went to Tabora for discussions on inland fisheries with the Chairman and the Conservator of the Fauna and Advisory Board of the Transvaal who were members of a South African mission touring East Africa by air.

His Excellency the Governor inspected the Kingdom Fisheries Office in February. Visitors to the office have included a Provincial Administration party from Northern Rhodesia, research workers from the Belgian Congo and a fisheries expert of the Colonial Development Corporation.

Acknowledgment is made of much valuable co-operation with the Provincial Administration and grateful thanks are tendered for much willing assistance given by busy colleagues in the Department of Agriculture.

Publications

"The Investigation and Development of Indian Fisheries in Tanganyika Territory" by G. J. Lockley. Comptes-Rendus de la Conference Piscicole Anglo-Belge (1949). Publ. Dir. Agric. Min. Col. et Gov. Gen. du Congo Belge. 1950, pp. 135—138.

This has again been an excellent year for the Territory's most valuable fishery. In 1950, 1,223·2 tons of sun-dried dagaa, valued at £73,392 were exported from Kigoma. Monthly exports are shown in Appendix A.

This product has been in strong demand by employers of fed labour both in the Territory and in the Belgian Congo. In an endeavour to ensure continuing supplies within the Territory during the off fishing season the export of dagaa to the Congo was prohibited from March to July inclusive. This arrangement worked well. Steady markets were maintained in the Territory throughout the year and, when export re-opened in August, considerably higher prices were obtained in the Congo markets at a time when supplies were bountiful and Territorial demands did not suffer.

Work on the dagaa fishery has taken two lines: examination of catches and collection of data towards the elucidation of the biology of these fish and an investigation into the complicated economic and sociological structure of this fishery.

The separation of the two closely related species of Clupeid *Stolothrissa tanganicae* and *Limnothrissa miodon* which comprise the dagaa catches is not an easy matter and must be carried out on fresh or well preserved samples. For this reason, at present it has only been possible to examine catches from the vicinity of Kigoma. In this area the bulk of the dagaa catch consists of *Stolothrissa.*

The main productive area for dagaa is the Northern end of the Lake where large shoals appear from July until the end of the year. Sixty per cent of the catch at the present time come from Kigoma District, thirty per cent from Ufipa and ten per cent from Mpanda and Kasulu combined. It is not yet known whether this is due to the actual distribution of the fish or to factors such as distribution of fishing populations, access to markets, etc. It is interesting to note that the natives claim that there are no dagaa on the Western (Belgian) shores of the lake. This requires confirmation, particularly in view of the factor that until comparatively recently mesh-restrictions were in force on the Congo side in the mistaken belief that dagaa were the fry of large species of fish.

Any extension work amongst dagaa fishermen must take into account the exceedingly complicated structure of this fishery. Traditionally, each dagaa boat has seven "shares" (mafunga) representing the fisherman, the paddler, the boat owner, the net owner, the supplier of flare fuel, the supplier of food and the business manager (itinerant trader). There may actually be seven men involved in these capacities in a dagaa fishing venture, each of whom receives a seventh of the takings but again there are various combinations e.g. the fisherman may also be both net-owner and boat-owner or both fisherman and paddler may supply their own food. Everyone involved in the dagaa fishery describes himself as a fisherman even though he may

never venture on the water. Any attempts to introduce improved methods into this fishery must take cognizance of the fact that there are very few completely independent fishermen and many vested interests.

With great prosperity accruing from the dagaa fishery there has been little incentive to engage in the less lucrative fisheries for other species. There has nevertheless been an improvement in the supplies of fresh and smoked fish in the Kigoma-Ujiji area. This was due in part to the increase in the supplies of fishing gear which it has been possible for the Fisheries Officer to organise and in part to good and steady fishing by seine-net fishermen from Nyasaland and the Congo who are now operating in this area.

Record of all fish landed at Ujiji market have been collected throughout the year. Whilst these figures require fuller analysis, it is now possible to say that the most important economic demersal species at present are the predators *Lates microlepis* and *L. angustifrons* ("Nile Perch") and *Boulengerochromis microlepis* ("Yellowbelly"). These figures, coupled with the results of experimental fishing by the Fisheries Officer, have also revealed that certain groups of fish which appear to be abundant in the lake are at present but little exploited by the native fisherman.

With the improvement in the supply of manufactured nets during the year, there has been a notable increase in the use of gillnets, a form of gear but little used on this lake in the past. There is no doubt that many areas of the lake could support a sizeable gill-net fishery whose results would rank high when contrasted with catches with this gear elsewhere.

As a result of discussions with the Native Authority, canoe-licensing will be introduced in Kigoma District in 1951. It is to be hoped that the neighbouring Districts will follow suit if some approximate idea of the extent of native fishing effort on this lake is to be gauged.

The Malagarasi

There has been a steady expansion in the fisheries of the Malagarasi river, its swamps and tributaries. The only available statistics, those of fish railed from Nguruka: 21·8 tons of fresh fish valued at £1,744 and smoked 115·8 tons valued at £8,106 do not accurately reflect the volume or value of this fishery whose products are also exported in many different directions by road and by foot.

A European firm are now installed at Katare on the Magoma swamp north of Nguruka. They are not fishing but are purchasing native caught fish. Their intention is to freeze for sale on the Central Line but their freezing equipment has not yet arrived. In the meantime they are smoking fish for export. This company, which pays cash for fish, are performing a useful function in breaking up the hold which the many middlemen have had on the fisherman in this area.

Experimental netting carried out by the Fisheries Officer this year both in the swamps and in the Malagarasi River at Uvinza has continued to reveal dense populations of fish which are virtually unexploited at present. *Tilapia nilotica* and *T. karomo* remain the mainstay of the swamp fishery but efforts made to encourage the fishery for other species are beginning to bear fruit. Unfortunately the most productive method, gill-netting, is liable to interference from crocodile, but the crocodile menace has been considerably reduced in the Katare area where European crocodile hunters have been operating this year.

Apart from small collections made in the headwaters in Ruanda-Urundi and in the delta area by Belgian investigators, the fish fauna of the Malagarasi appears not to have been investigated or described. It is therefore not surprising that routine netting operations have produced species of fish, often in considerable numbers, which it has not been possible to identify with any certainty and which may well prove to be new species. A collection has been preserved for identification by the British Museum (Natural History). Such species as have been indentified with certainty by the Fisheries Officer indicate a remarkable affinity between the fish fauna of the Malagarasi and that of the Congo system.

Exploitation of the fish resources of this vast, little-known system of waterways of the Western Province is dependent on communications and other developments in the area. In this connection it can be recorded that a road is now under construction from Kigoma to the Malagarasi mouth which should do much to increase fish production in the lower reaches of the river. The completion of the branch railway line to Mpanda has already led to an increase in fishing in the swamps south of the Central Line and in the Ugalla.

Lake Rukwa

In 1950, for the first year in over ten, there was no commercial fishery on Lake Rukwa. This marks the end of an era in which various European concessionaires had accounted for a total catch of at least fifteen million *Tilapia*, or 7,500 tons of fresh fish. The present closure is the legacy of the years of drought, culminating in the great drought of 1949. The 1949-50 rains in the Rukwa catchment area were very satisfactory and the lake received a considerable amount of water, but not enough to restore it to the level which was associated with the good fishing years. This lake, even after a season of good rains, has a maximum depth of only about 12ft. and it is not possible to speak of a "normal" level for Rukwa which, in addition to the considerable annual fluctuations due to the difference between precipitation and evaporation is also subject to violent flooding or desiccation over a period of years. At the time of writing it would appear that the evaporation/precipitation ratio in 1950 has not been so severe as that of the previous year but the lake has shrunk considerably and a season of flooding, by several years of good rains would seem to be necessary if Rukwa is to regain its former status as a lake.

One significant result of the drought has been a drastic alteration in the character of the shore-line. This, with the exception of the delta areas, formerly consisted mainly of open sand or pebble beaches. With the drying out of the lake bottom in 1949, vegetation rapidly established itself on the newly exposed areas of mud between the old sterile beaches and the retreating lake edge forming, in some places, a barrier nearly a mile in depth. When the lake rose in 1950 much of this vegetation was wholly or partly submerged but, with the annual fall, the inshore growth was consolidating. Apart from its effect on the ecological balance of the lake, this vegetation will present a formidable obstacle to the resumption of commercial fishing which formerly relied entirely on beach seining.

In May the Fisheries Officer carried out an investigation of the fish stocks at the south end of the lake. It is gratifying to record that *Tilapia rukwaensis* was found to have survived the drought. Fry and fingerlings of this species, representing the progeny of at least three separate spawnings, were plentiful in the inshore waters but very few larger fish were seen. Hauls with a full size commercial seine net of four inches and sets of five-inch mesh gill-nets were both blank in respect of *Tilapia*. The local natives who fish with a scoop-net (''luelo'') having a four-inch mesh claimed that they could not catch any of this species. It was concluded that whilst the *Tilapia* appear to be rapidly re-establishing themselves, larger fish of marketable size were not yet present in sufficient quantity to justify the re-opening of a commerical fishery. This should wait until at least April 1951 i.e. after the next rains. By that time many of the present young fish would have reached sexual maturity and would have spawned at least once and, with the normal rapid growth-rate of *Tilapia* up to sexual maturity there should be an increase in the number of fish of a size large enough to be caught in existing gear. It should be emphasized however, that much depends on the behaviour of the lake. It is scarcely possible to apply the normal methods of fisheries management to the fish population of such an unstable environment as this.

The Catfish, *Clarias mossambicus* (''kambale'') was found to be abundant. This species, which possesses an accessory air-breathing apparatus, is exceptionally drought resistant. Kambale now form the main catch of the local native fishery. Data on the line fishery for this species pertaining to 306 canoe-days in the Chunya District area of the lake were collected in August. This fishing effort yielded 5,692 *Clarias*, an average of 18·6 fish per canoe-day. The average weight of these fish is one-and-a-half lb. The local population therefore appear to be ensured of a protein supply.

Minor Waters

Several small lakes, dams, etc., in the Western Province were examined during the year. None of these offered any immediate prospects of the establishment of commercial fisheries. It is not often realised that most small stretches of water in this country, including dams, are often rapidly

colonised naturally by fish. There are few waters which do not contain the ubiquitous "Kambale" (*Clarias mossambicus*), a species which is capable of making short journeys across dry land to reach new territory. The fact that angling does not produce results in any water is not to say that it does not contain fish. One small farm dam in Nzega District was found to contain no less than eight species of fish of neither sporting nor culinary interest. Nevertheless such natural populations must be taken into account before stocking is contemplated as not only may predators be present but there may be severe competition for food supplies.

In June, a short investigation of Lake Ikimba in Bukoba District was undertaken. This small lake supports an important local fishery for *Tilapia variabilis*, a species of Lake Victoria with which Ikimba is connected by river systems. A report prepared on this fishery has been passed to the East African Fisheries Research Organisation with a request that they will include the Ikimba population in their present study of *Tilapia variabilis* in Lake Victoria.

Crocodiles

The boom in wet-salted crocodile hides continues and there is no doubt that this industry has enjoyed a profitable year. At present the only official requirement to engage in crocodile hunting is to be in possession of a Trophy Dealer's licence and no returns of beasts killed or skins prepared are required to be submitted. It is therefore not possible to gauge the volume or extent of this trade. It appears that Lake Rukwa still leads the East African market in quality and quantity of skins. Other areas where crocodile hides are being produced that have come to the Fisheries Officer's notice during the year have been the Malagarasi Swamps, the Malagarasi and Lugufu areas of Lake Tanganyika, the Ugalla and the Rufiji. It should also be noted that there has been a considerable increase in this trade on Lake Victoria whose fisheries are not under the jurisdiction of this Department.

The normal species of Crocodile that occurs throughout the Territory is *Crocodile niloticus* but the West African Long Nosed Crocodiles, *Crocodilus cataphractus* also occurs in the vicinity of Lake Tanganyika which appears to be about the eastern limit of its distribution. It has been noted during the year in the lower reaches of the Luiche, Malagarasi and Lugufu rivers and in ponds in the region of Kigoma. This species does not attain the size of the Nilotic crocodile but a skin submitted for tanning was reported on favourably.

Miscellaneous

Amongst the various odd jobs undertaken by the Fisheries Officer during the year was the collection and preservation for various scientific institutions of specimens of Storms' Water Cobra (*Boulengerina annulata stormsi*). This species of water snake is endemic to Lake Tanganyika. It reaches a length of eight feet, is venomous and is a voracious fish-eater.

G. J. Lockley,
Fisheries Officer (Inland)

ANNUAL REPORT OF THE FISHERIES OFFICER, KOROGWE, FOR THE YEAR, 1950

The current year constitutes my second year in the Territory, and whereas the first year was mainly concerned with initial surveys and construction, the year 1950 has been devoted to a number of very promising initial experiments.

Concurrently also the Experimental and Breeding Station at Korogwe has been systematically extended and now consists of six small fry ponds, six breeding ponds, five production ponds and one rice pond, giving an area of nearly fifteen acres of water.

Species of Fish

Most of the experiments have been carried out with *Tilapia nilotica* which is indigenous to the adjoining Pangani River. In addition, two species, *Tilapia esculenta* and *Tilapia variabilis* have been introduced from Lake Victoria (three days by rail) and a third species *Tilapia mossambica* from Lake Jipe (150 miles by road). Experiments carried out with the indigenous *Clarias mossambicus* lead me to believe that this species is unsuitable for pond cultivation.

The three exotic species are all breeding at Korogwe and fry have been grown to the fingerling stage. It is intended to use the two Lake Victoria species for stocking ponds at the higher altitudes (Lake Victoria is 3,700 ft.) while *Tilapia mossambica* will be utilized in districts where the water is saline and possibly at a later date for marine ponds.

At the end of the year a number of fingerlings of *Tilapia melanopleura* and *Tipalia macrochir* were received by air from the Belgian Congo (one-and-a-half days by air). If we are successful in breeding these two species, we may be able to attain a higher production figure as these fish are complementary feeders.

In general it is thought that we shall now have a range of selectivity to suit almost all conditions in the Territory. The utilisation of these after experiments have been conducted may be as under :

T. nilotica—general utility—feeds on decaying vegetation—tolerates high salinity of water.

T. mossambica—almost omnivorous—tolerates extreme heat in shallow water—will live and breed in the sea, suitable for marine ponds.

T. esculenta—will possibly live and breed at medium altitudes—appears to have high growth rate in Korogwe.

T. variabilis—appears to have lower fecundity than *Tilapia esculenta* which might prove useful in certain circumstances.

T. melanopleura—herbivorous—extremely useful for clearing up grass round the banks of a pond where malarial mosquitoes breed—tolerates high salinity of water.

T. macrochir—planktonivorous and can therefore be used as a complementary feeder to the other five species—is said to be living and breeding at over 5,000 ft. in the Transvaal.

Growth Rate Experiments

Two major experiments have been carried out to ascertain the growth rate of *Tilapia nilotica*, one in the cold weather and the other in the hot season. The experiments were carried out in the same pond which has an area of ·69 acres. The pond has been excavated in the sub soil to a depth of two-and-a-half feet and has a clay bottom. No artificial feeding was resorted to, but the rich water of the Pangani River produces vast masses of spirogyra and has a pH of 8·4. There was no continuous current through the pond, but losses of water due to evaporation and seepage were made good as required.

The first experiment was carried out during the period 31.12.49 to 31.3.50, 3,000 fingerlings which had been bred in the station to 5/6 cms. were introduced.

In addition to the spirogyra the water had a high plankton content with considerable quantities of decayed vegetable matter from the Pangani River.

On 2.3.50 a five-foot crocodile was observed to have taken up residence in the pond and the following day I lowered the water level to nine inches, and the crocodile was killed. No trace of fish was found in his stomach or intestines although he had 3,000 fish at his mercy for twenty-four hours.

I have had similar experience with a number of crocodiles on subsequent occasions and have come to the conclusion that in an open pond the Tilapia is much too fast for the crocodile to catch. Often crocodiles come into a pond and after a few days go back to the River, apparently very disgusted by our efforts at fish culture.

The lowering of the water in the pond revealed that the Tilapia had already started breeding as a number of nests were under construction: the pond was immediately refilled, and was finally emptied again on 31.3.50 to harvest the fish

In all 420 lb. of the Tilapia were taken out and the greater part sold to a neighbouring sisal estate for feeding their labourers. The estate collected the fish in a three-ton lorry with six forty-gallon drums containing water and the fish were alive at the end of their thirty miles journey.

These labourers had seldom seen fresh fish before and ate them with great relish. The price was fifty cents per lb.

The average size of the Tilapia was seventeen to eighteen cms. with larger specimens to twenty-five cms.—all in excellent condition.

When the pond was finally emptied about 200 nests were visible under construction although very few fry were caught.

The second experiment was carried out in the same pond as the first and during the period 3.7.50 to 3.10.50. The results from this trial give information as to growth in the cold water, whereas the first trial was conducted during

the hot weather. Again no artificial food was introduced and there was no appreciable variation in water level, during the trial.

A lower stocking density, however, was tried, only 2,000 fingerlings being put in as compared with 3,000 in the first experiment.

The quantity of fish taken out was 375 lb.

Averaging the results of these two trials it would seem that a production of 2,287 lb. per acre per annum might be expected as a mean figure for three month trials throughout the year. Some hundreds of nests were again seen on the pond bottom and it is estimated that fifty per cent of the fish taken out were sexually mature.

It was observed however that the quantity of fry taken out was not greatly in excess of that required for restocking the pond and it would seem therefore the wastage of effort caused by fry production is reduced to a minimum in a three-monthly production period.

For local consumption the size of the fish is not important apparently, and I therefore incline to the opinion that a three-month growth production period may prove the ultimate answer as the most economic period for harvesting, and that a one acre pond might be a self contained unit, providing its own replacement stock, without the necessity of a separate breeding establishment. For harvesting, the pond would be completely drained and replenished at a definite stocking density.

A third experiment, which was not completed by the end of the year is in progress, to determine the growth rate for a six-monthly period.

Rice cum Fish Experiment

A further experiment was carried out at Korogwe to determine whether rice could be grown successfully in water deep enough to rear fish at the same time.

This is the practice in Bengal where I lived a number of years and in the Far East generally. The theory underlying the experiment is that when rice is grown under water an algae slime grows on the rice stem. The Tilapia suck off this slime which constitutes their major item of food in the rice ponds and the removal of the slime is said to benefit the growth of the rice. The excreta of the Tilapia also doubtless has a manurial value to the rice.

Figures in India show an increase of 150 lb. per acre in the rice crop, and similar results have obtained in China.

It appears to be customary in this area to grow rice in slushy ground and shallow water pools created during the rainy period, and the season therefore is strictly limited, and if the rains fail, so does the rice. It was thought that if rice were grown in a two-feet deep pond it might be possible to grow it independently of the local season, and possibly get two crops a year in addition to two fish crops.

A pond of 3·1 acres was made with earth banks two-and-a-half feet high, and was flooded with sufficient water to create a slush over the bottom. On

21.6.50, one hundred lb. of the local species of rice was planted in a prepared seed bed on the pond bottom, which was kept in a slushy state by additional water as required. By 18.8.50 the rice had grown to a height of twelve inches and transplanting commenced. It was intended that it should be planted six inches apart but when finally finished I am afraid the average distance was more than a foot. On completion of the transplanting the water level was immediately raised to a height half-way up the rice stem, and the water level was continually raised as the rice grew. By 4.10.50 there was a foot of water in the pond and 2,900 *Tilapia nilotica* fingerlings were introduced. Finally the water level was slowly raised to two feet and the rice started to flower. From now to the end of the trial every artifice had to be employed to keep off birds, which gave great trouble.

Harvesting of the rice commenced on 7.11.50 and continued until 6.1.51. It was thought better to harvest over a long period cutting every stalk of rice as soon as it was ripe in order to reduce the depredation of the birds to a minimum

The total quantity harvested was 5,944 lb. but in extension of this I would say that the rice stalks were only lightly threshed and not given a second beating after drying, as I wished to use these stalks with the adhering rice for a feeding experiment in one of my other ponds.

The fish crop was harvested on 12.1.51. The operation proved rather difficult owing to the uneven nature of the bottom which produced large numbers of small pools when the water was emptied. However 285 lb. of fish were recovered.

The interests of the fish were always subordinated to that of the rice when difficulties arose. Further the period of growth was foreshortened to harvest the rice.

Summarizing, the experiment showed a production of 1,918 lb. of rice per acre plus ninety-two lb. of fish per acre.

This result cannot be regarded as unsatisfactory if I mention that the Veterinary Department advised me that this land has never produced previously more than ten lb. of beef per acre per annum.

Further the rice was grown out of season : it might be possible to get two crops per annum of rice and certainly possible to get two crops of fish. It is intended to continue this experiment using a species of rice with a longer maturation period, and using a higher stocking density of fish.

Extension and Training

During the year in addition to training my maintenance and operational staff at Korogwe, three agricultural instructors have received a three months fishery course here, embracing pond management, breeding operations, identification of species, natural foods, and pond construction including masonry work. They have also seen transport of fish of varying ages by air, road, and rail and have made a number of visits with me to see other ponds in the Territory.

Next year's programme envisages the building of a training school at Korogwe with residential quarters for Europeans and Africans.

Additional ponds are also to be constructed which will bring the total area of ponds at Korogwe to nearly twenty-five acres.

Visits and Tours

His Excellency the Governor visited the Station in September, and during the year other visitors included the Member for Agriculture and Natural Resources, the Director of Agriculture, the Director of Water Development, the Director of Public Works, the Provincial Commissioner and a large number of administrative and technical officers.

During December the writer spent one month's local leave visiting Zanzibar, Nyasaland, Portuguese East Africa, Southern Rhodesia and the Union of South Africa. Fisheries officials were met in every country and fishery experimental and research stations and museums visited. The exchange of information proved very useful to supplement my previous visits to the Belgian Congo, Northern Rhodesia and Kenya.

In particular I must refer to the extreme courtesy extended to me by Dr. D. Hey, Director of Inland Fisheries, Capetown; Dr. K. H. Barnard, Curator of the National Biological Museum, Capetown; Mr. N. Borley, Director of Fisheries, Nyasaland; and Mr. K. N. King, Fisheries Officer, Zanzibar.

Officials of the Colonial Development Corporation (Fisheries Section) also visited us on a number of occasions during the year and were escorted by me over large areas of the Territory to find suitable places for a major fish farming project.

Safaris were made over a wide area of the Territory advising as to the lay-out of ponds, and transporting species for stocking natural and artificial waters. A four-acre fish farm has been established in H.M. Prison, Moshi, where the prisoners are being taught pond management and at the same time given a welcome variation of diet occasionally.

I shall always remember my first visit to this prison when I took 1,000 fingerlings from Korogwe to stock the first pond. The Superintendent asked me to give the assembled prisoners a talk on fish and I discovered that many of the prisoners from waterless parts of the country had never seen a fish before and did not know whether it crawled about in the bush or flew in the sky!

Legislation

During the year a Fisheries Ordinance was enacted for the first time in the history of the Territory. One of its chief objects of immediate importance was to forbid the importation of all exotic species except by special permit.

It is hoped thus to protect our valuable indigenous species from disastrous destruction by comparatively useless exotic species as has happened in other parts of Africa.

R. E. Gould,
Fisheries Officer

ANNUAL REPORT OF THE BEESWAX OFFICER, TABORA, FOR THE YEAR 1950.

Touring

From the 15th March, when the Beeswax Officer's vehicle arrived, until the end of the year, 11,055 miles were travelled in examining the principal beekeeping areas throughout the Territory. On these tours, study was made of the vegetation types, beekeeping methods, improvements required in the preparation of beeswax and honey, marketing methods and lines of export, and immediate requirements of instructors. Where applicable, contact was made with those Government services whose activities have connection with the beekeeping industry, namely, the Administration, the Forest Department, the Game Department and tsetse reclamation services, with a view to mutual co-operation.

Apiculture

At Talikwa, in Miombo country eleven miles South of Tabora, a research Out-Apiary has been constructed, giving complete protection to the hives from insect and animal predators, together with a house for the apiary guards. In addition to a number of miombo bark hives, Langstroth frame hives have been in use. One Langstroth hive is kept on a platform scale and periodic weight readings are recorded.

In the dry season during August a feeding experiment was tried on the scale hive. It was found that the bees on finding sugar syrup in the feeder, flew around excitedly until the syrup was finished, thus wasting the food instead of storing it. Eleven and a half pounds of 1 : 1 sugar : water syrup were fed to the bees on 8th August. On the 14th August, the feeder was empty and the net increase in weight was only three and a half pounds. It would appear that feeding during the dry season is not profitable from the point of view of increasing stores, but it may be of long term value in increasing brood rearing.

The trees in favourable areas began flowering at the beginning of September. The effect of this was shown in a slight increase in the hive weight. For the next six weeks however the hive weight remained constant. All stores were consumed and in spite of the light honey flow, no reserves of stores were built up. The brood nest however expanded rapidly. About the 24th October the short rains began and from that date the scale hive increased in weight steadily. It was necessary to give a second body box on the 8th November and a third on the 7th of December. The second and third weeks of December were however dry, the flowering of the trees ceased and little increase was shown. During the last week, the hive began to lose weight but at the end of the month heavy rains occurred and the bees resumed foraging, with a resulting increase in weight.

In the early part of the year, there was very little flowering of the trees in the miombo forest areas, though the acacias in Central Province responded quickly to the more abundant rains in that region. The principal honey tree, *Isoberlinia globiflora*, was seen to flower only in the more favourable areas in the Western districts of Western Province.

The new flowering season, starting in September, began well. All trees that usually flower in the early rains did so, including *Brachystegia speciformis*, *Brachystegia longifolia*, *Brachystegia boehmii*, *Pterocarpus angolensis*, *Albizzia antunesiana*, *Burkea africana* and *Tamarindus indica*. By the beginning of December however the miombo forest trees of value to the bees had practically all ceased flowering. Reports coming in at this time indicated that the bees had built up to full strength in many cases and were swarming. The prospects for the new season looked very much more promising than the same time last year.

During the main harvesting season, June and July, a number of hives were examined including some two-chambered hives. The average total weight of honey comb and wax was nine pounds per hive. The two-chambered hives had not worked according to plan. The bees were either one side or other of the queen-excluding partition. In no case were they on both sides of it. Further experiments are being carried out with the two-chamber hive idea.

While most beekeepers destroy the brood nest when collecting the beeswax and honey, it was found that the Wachagga, certain of the Waha and throughout the beekeeping areas of Southern Province, care was taken to preserve the brood nest. On the other hand, honey hunting, the searching of nests in hollow trees, is practised widely, especially in game reserves where there is permanent water and a large bee population and the hanging of bee hives is forbidden. The honey hunters invariably destroy the colony, by cutting open the tree and removing all the combs, often starting fires in their efforts to smoke the bees out of the tree. Beekeepers, who use bee hives, are far more careful with fire. Although they have to make smoke to control the bees, they keep their fires under control as they do not want to start forest fires that will destroy their hives.

A study is being made of the sources of nectar and flowering periods. A herbarium of honey plants has been started and initial investigation on pollen analysis begun. With the arrival of suitable equipment these studies will continue.

Regulations have been prepared to prevent the introduction of bee diseases into the Territory. Up to the present time, none of the bee diseases found in Europe, America and the Dominions have appeared in East Africa. Owing to the importance of the Beekeeping Industry and the primitive nature of the beekeeping, it is of the utmost importance that diseases are kept out.

Marketing of Beeswax

The 1949—1950 Beeswax season has been one of the worst on recent record, due to the after effects of the poor rains of 1947—1948 and the drought of 1948—1949.

The export figures for the past seven years are as follows :—

	Tons
1944	627
1945	792
1946	732
1947	410
1948	905
1949	525
1950 Jan. to Sep.	227.35
1950 Estimates	340

Owing to the world demand exceeding the supply of beeswax, the Dar es Salaam price has risen during the year from about £300 per ton to £485 per ton. The present true f.o.b. price which includes the export tax of £25 per ton, is £510. A great part of this increase is due to the devaluation of the pound sterling, as the U.S.A. has been buying considerable quantities of beeswax through the London market.

Throughout most of Western Province the standard of preparation of beeswax has been good. In Central Province however the standard is poor, the cakes being dirty and often adulterated with trigona wax. In Southern Province very little rendering is carried out by the natives, the wax being sold in the form of pressed balls.

Where cleaning is carried out by the shippers in Dar es Salaam, in most cases the wax passed through the clearing process is of a low quality, principally owing to the use of rusty or black iron vessels. Wax exported from Lindi has all been passed through either the traders or the shippers clearing processes. The use of brackish water in Lindi, as well as unsuitable vessels, results in the damage and loss of quality of most of the Lindi wax.

The matter of regulations governing the export of beeswax has been carefully studied and the present system found unsatisfactory. Recommendations have been made for its improvement and to ensure that good quality beeswax is exported.

Trigona Wax

A special study has been made of the problem of the use of trigona wax as an adulterant of beeswax. A paper on the preliminary findings has been prepared for publication. Further work on this subject will be carried out in 1951.

Honey Marketing

The honey produced in Tanganyika is mostly consumed within the Territory. Some is exported from Central Province to Kenya. Less than one ton was exported outside East Africa. There is little prospect of exporting honey unless production exceeds local demand. The present internal price of honey is so high that export could only be undertaken at a loss.

The London market is flooded with Australian honey at Shs. 72 6 per cwt. c.i.f. U.K. Thirty-two million pounds were imported into the U.K. in the 1948—1949 season and slightly below twenty million pounds in 1949—1950. At present stocks in the U.K. are estimated at eighteen million pounds, sufficient to meet a year's requirements. In addition, eighteen million pounds have been imported from Argentina under the terms of the Anglo-Argentine trade agreement.

Extension Work

Constant instruction and demonstration has been carried out throughout Tabora and Kahama District by the African staff. An instructor has recently been appointed to the Nyonga Area of Mpanda District. Instructional tours have been undertaken throughout Central Province by two of the African staff and barazas have been held in the Chunya District of Southern Highlands Province.

A beekeeping stand was on show at the Natural Resources show at Mbeya. Samples of beeswax and honey and beekeeping equipment were exhibited. An observation hive stocked with bees aroused much interest. There was also a demonstration of rendering beeswax.

Instructions on the clearing of beeswax were circulated to shippers and a pamphlet prepared on "Modern Methods of Rendering Beeswax".

In response to numerous requests from beekeepers and prospective beekeepers and in view of the lack of knowledge on beekeeping matters that exists among many administrative and departmental officers, some notes on beekeeping in Tanganyika has been prepared, together with drawings of frame and primitive hives.

The work of compiling material for a more complete illustrated manual on beekeeping in Tanganyika has been begun.

The findings on trigona wax have been written up and submitted for publication in the *East African Agricultural Journal*.

Advice on beekeeping has been given to the Overseas Food Corporation at both Urambo and Kongwa.

Buildings

Early in the year, a protective apiary banda and apiary guards' house were constructed at Talikwa in the hills above Uruma, some eleven miles south of Tabora. This banda houses the scale hive and other frame hives.

A site for the Beekeeping Research Station within the Township of Tabora was selected and the levels taken. Plans and estimates were drawn up for the Research Station buildings. Later, objections were raised to the location of the Beekeeping Research Station within the Township on the grounds of potential nuisance. Further difficulties were encountered in establishing the ownership of the proposed plot. Another site was therefore selected outside the Township, but no further action has been taken pending authority to set up the permanent headquarters of the Beekeeping Division at Songea.

F. G. Smith, *Beeswax Officer*

PROGRESS REPORT OF THE EMPIRE COTTON GROWING CORPORATION, UKIRIGURU, FOR THE SEASON 1949-1950

Cotton, Ukiriguru

Planting : 28th November to 18th January.
Picking : May to September.
Legal Uprooting Date : 14th September.
Rainfall : 1st October-30th June : 28·97 inches.
(Lubaga, 1st October-30th June : 30·63 inches).

Meteorology.—In spite of a fairly late start the rainfall distribution was good, with over five inches each in the months December and January, and no severe dry spells during the growing season. After earlier dry planting, the main planting started with the first good rain on December 8th. The season was a short one; the last heavy rain was on the 19th April.

Development:—The Public Works Department building programme is nearing completion. This comprises the laboratory-office block, the new ginnery, the labour quarters, and the stores.

On Ukiriguru a Farmall MDV. Cane Tractor with a disc bedder, has been at work breaking down and levelling, and re-ridging the standard five-foot ridges on the light lands. It has been doing very reasonable work at an all-in costing of somewhere around Shs. 30/- an acre for the completed operation. An MV2 cane plough for ridge breaking and remaking is awaited.

At the end of the year, labour was very short, and it would have been quite impossible even to attempt to ridge the area required for cotton planting, by hand-hoe labour. (No adequate permanent labour force housed on Ukiriguru is yet possible until the labour lines are completed and available. There is still dependence on casual labour from the area around).

General Introduction

Cotton Crop.—The cotton for the season has amounted to not far short of 40,000 bales. Considering the circumstances this must be considered reasonable. As forecast in the 1948-49 report—following the serious food shortages—with the coming of the 1949 planting rains the emphasis had to be on food. There was in the end a large cotton acreage, but much was planted in late January and February—around two months later than is desirable. Furthermore there had been early plantings of maize, and considerable December plantings. (Broadly speaking maize is not a main food crop in the cotton areas of the Lake Province, and is liable to droughting). There was considerable breeding-up of American Bollworm on these maize plantings: it attacked cotton from the end of February, developing seriously from early April. There was heavy crop loss on much of the cotton grown in the Province—especially striking on the late-planted cotton. On very many crops only a third to a half crop was reaped. This was so on Ukiriguru.

A production of 10,000 bales therefore represented an acreage planted, and effort on the part of the cultivators, which under other circumstances could have resulted in a very much larger production.

The planting of maize has been discouraged this 1950-51 season, until after mid-January.

Lake Province Cotton Committee.—A further six Agricultural Assistants (now a total of seven out of the fourteen approved), and the Secretary, were appointed to the Lake Province Cotton Committee; and the recruiting of four hundred Instructors for this work was started.

Tractors and tractor equipment arrived for two pilot mechanisation schemes. Very valuable information has been got from the first months of working. It seems highly likely that, when more experience has been gained, there will be a very rapid increase in the mechanised preparation of land. The tractor and implements in use on Ukiriguru provide important additional information on a further side of this work; and when ridging by tractor is extended into the districts it will undoubtedly be an important factor to earlier cotton planting, and improved and increased production.

The activities of the Lake Province Cotton Committee can only start to influence efficient husbandry in 1950-51; and indeed it is highly probable that their activities will not begin to have much appreciable influence until the following season or even later.

Seed Multiplication.—In 1949-50, U.K.46 covered the Mwanza and Geita districts. It was a bad jassid year: Mz.561 suffered. U.K.46, in jassid resistance, showed up well, where it bordered Mz.561. This 1950-51 season it covers the Province, with the exception of Shinyanga district. (Ginning difficulties prevented enough seed being available in time to complete the planting of the whole Province with U.K.46).

U.K.48, superior to U.K.46, will cover in 1950-51 the Buchosa zone in the Geita district; it will be in its third year of multiplication.

1950-51 Cotton Planting.—There has been a certain reluctance to start timely land preparation and cotton planting (and early cotton planting is of the highest importance to good yields). This reluctance undoubtedly is influenced by the good food crop harvest of last year, and the good profits made from hedge-row sisal, the production of which during the year amounted to some thousands of tons. It will probably mean a substantially reduced 1951 acreage, and thus a reduced production.

In the October-November report of the Regional Assistant Director of Agriculture, the sum of Shs. 1/60 per kilo was mentioned as around the average price paid for this sisal to the cultivator, compared to a price of twenty-five cents per pound of seed cotton Grade A paid to the grower last season, and a price of thirty-four cents per pound Grade A for this coming season. Such cotton prices of course are very substantially less than could be paid. The hedge-row sisal price is not controlled; the cotton price is.

Against the background of what is very largely a simple peasantry—whose cash needs are as yet not great—it may well be necessary to review the profits being obtained from such exploitation of hedge-row sisal, against the stimulus to cash planting as a regular part of the agricultural pattern.

Summary of the Main Experimental Results

Significant residual responses were measured at Ukiriguru in three resting crop trials—the sixth year of cropping for two of the trials, and the fourth year of cropping for the third trial.

In a trial at Ukiriguru in its second year of the cropping cycle—comparing continuous land cropping with alternate cycles of resting and cropping—the "tumbledown" fallow plots, which last season were depressed, this season showed significantly the heaviest yields.

At Ukiriguru the results from direct manuring are again very good—up to a doubling of the crop. In a further experiment significant residual benefits were measured in the sixth indicator crop since the application of organic manure. There were residual responses showing from phosphate applications.

Sulphate of ammonia, applied before flowering, has given a worth-while increase at Ukiriguru on poor land. The combination of nitrogen and phosphate in amounts roughly equivalent to the amounts of these nutrients in the organic dressing has given equivalent yields. Any explanation of the residual benefits from organic manuring is more difficult.

Tied ridges on the Ukiriguru hill land compared to poorer ridging not tied showed no increased yield for millet, though earlier in the season benefit had been apparent. But in one trial an appreciable benefit to cotton resulted—the more when stalked weights were used as the measure. In a second trial there was an increased residual benefit from manuring on the tied plots compared to the non-tied. At Lubaga there were substantial benefits from ridged compared to flat cultivation, but no benefits from the tying.

Not much is known about agronomic treatment of the heavier lands. Ridging and ploughing on the Ukiriguru "mbuga" gave reductions in yield compared to flat cultivation and non-ploughing. Some measure is given of the reduction in crop due to unchecked weed growth.

U.K.46 has shown up as a worthwhile issue, with much superior jassid resistance to MZ.561; and U.K.48 is superior to U.K.46. Very satisfactory yield trial figures are given. A U.K. 51, constituted from high yielding strains, is mooted.

The dominant feature of the year was a heavy attack of American Bollworm, causing very serious loss. Jassid was also severe, as was bacterial blight on susceptible material. The severe jassid attack allowed further assessment of resistance. The resistance to bacterial blight showing in strains of "local" origin is considered insufficient.

Husbandry

Land Resting: The four simple resting crop trials at Ukiriguru, referred to in earlier reports, two now in their sixth year of cropping and two in their fourth year, were this year planted with cotton as the indicator crop.

TABLE 1

Ukiriguru Hill Sand — **Resting Crop Trials**

Treatment during three years Resting Cycle	Yield in lb. Seed Cotton per acre—1949–50					
	Sixth year of cropping				Fourth year of cropping	
	Trial 1		Trial 2		Trial 3	
1. Control — Continuous millet, grazed in third year. (Trial 3 not grazed)	276	100%	–	–	353	100%
2. Elephant Grass, grazed prior to digging in—third year. (Trial 3 grazed each year)	318	125	–	–	429	121
3. Bulrush millet, manured 1941–42 at 3 tons per acre F.Y.M., grazed before digging in	277	101	319	100%	–	–
4. Elephant Grass, manured 1941–42 at 3 tons per acre F.Y.M., grazed before digging in ...	306	112	444	139	–	–
5. Bulrush millet, manured 1944–45 at 5 tons per acre F.Y.M., not grazed	361	132	–	–	–	–
6. Elephant grass, manured 1944-45 at 5 tons per acre F.Y.M., not grazed	267	134				
7. *Cynodon* sp. – manured 1941–42 at 3 tons per acre F.Y.M., grazed before digging in ...	–	–	373	117	–	–
8. *Hyparrhenia* sp.-manured 1941-42 at 3 tons per acre F.Y.M., grazed before digging in ...	–	–	404	127	–	–
9. Pigeon Pea – no manure, grazed before digging in.	–	–			452	128
10. Pigeon Pea – manured 1941-42 at 3 tons per acre F.Y.M., grazed before digging in ...	–	–	364	114	–	–
Sig. Diff. (P.=.05)	75	21%	79	25%	61	12%

These trials are planted with bulrush millet and cotton in alternate years; in the past the millet indicator has shown a residual response to the grass rest in Trial (1), but not the two cotton crops. This year the

cotton indicator has responded, six years after the elephant grass was dug in. In Trial (2), where the elephant grass was manured in the year of establishment, the response has been consistent, averaging forty per cent above control over the six seasons. The *Hyparrhenia* plots have averaged thirty-three per cent, the *Cynodon* twenty five per cent, and the pigeon pea twenty-one per cent; but for these the responses have been more variable.

The yields of the first two indicator crops in Trial (6) are given in Table 2. The planted fallow (the grasses were *Cenchrus*, *Hyparrhenia*, *Brachiaria*, *Panicum*, and *Setaria* spp.) has given a substantial benefit in both years.

TABLE 2

Ukiriguru Hill Sand — **Trial 6**

Treatments during the three years' resting cycle	First two years of cropping cycle : indicator crop—Cotton			
1945–46 to 1947–48	Yield in lb. Seed Cotton per acre			
	1948-49		1949-50	
A. *Cropped during the resting cycle.*				
1. *Control :* continuous bulrush millet, undersown with food legumes	538	100%	607	100%
2. Continuous bulrush millet, undersown with food legumes—dressed three tons per acre compost for the 1948-49 season (previously dressed three tons per acre compost at establishment of experiment, 1945–46)	883	164	778	128
3. Continuous bulrush millet, undersown with food legumes—dressed 300 lb. single superphosphate per acre for the 1948–49 season (previously dressed 400 lb. per acre raw rock phosphate at establishment of experiment, 1945–46)	922	171	808	133
B. *Resting Treatments.*				
4. Three years planted grass fallow, undersown *Tephrosia* and *Crotalaria*—grazed ...	707	131	824	135
5. Three years' tumbledown fallow grazed	482	86	957	157
Sig. Diff. (P.=·05)	100	19%	118	19%

The "tumbledown" fallow, however, after a reduced yield in the first year, has outyielded all other treatments in the second year. The reasons for this can only be speculative : weed growth was mentioned in last year's report, especially the strong growth of *Tridax repens*. May it be that the poor crop last year was less of a drain on the nutrients in the soil, and the subsequent crop benefited. Similar residual efforts from rest have been recorded at Lubaga. One trial is now back under grass in a second cycle. A second

trial starts a new cycle in 1950-51: the treatments have been modified, and it is hoped to test a grass-legume mixture planted in alternate rows. A new set resting crop trials was started during the season, to compare the effects of three- four- and five-year grass rests, on flat and tie-ridged plots. The establishment of Cenchrus has been markedly better on the flat.

At Ukiriguru, there are two further resting crop trials, established in 1947-48 and 1948-49. The first of these is to stay for five years under resting treatment, and it is proposed to break up the other at the end of 1951.

There can be no doubt that the grazed grass rests have had a beneficial effect. The Elephant Grass used in the earlier trials is however not really suited to conditions in the Lake Province. Probably the best of the grasses at present worked with is African Foxtail *(Cenchrus ciliaris)*: Rhodes Grass *(Chloris gayana)* can be excellent for a couple of years, especially on better land, but then tends to die out; *Bothriochloa* sp. and *Brachiaria* sp., established from seed, are not really satisfactory. The best grass fallows obtained at Ukiriguru, even under conditions of controlled grazing, are by no means good. At Lubaga on the other hand a pure stand of Cenchrus is very impressive compared to the heavily overgrazed natural pastures round about.

Manuring and Fertilisers: Interest this year again lies in the direct and in the persistent residual effects of organic manures: the importance of phosphates and nitrogen; and what part these two nutrients may play in the organic complex.

Seed cotton yields were affected by the selective action of American Bollworm, and in some of the agronomic trials cotton stalk weights have been used as a measure of treatment effects. American Bollworm is seldom a very serious pest in the Lake Province; the infestation this year is exceptionally heavy. In a more normal year at Ukiriguru there is a high correlation between cotton stalk weights and yield. Three examples are given from last year :—

	Co-efficient of Correlation				(r) Stalk Weights —Yields	
	D.F.	Trial (6)	D.F.	Trial (8)	D.F.	Trial (9)
Treatments	5 ...	·997 ...	5 ...	·942 ...	4 ...	·974
Error	25 ...	·481 ...	35 ...	·686 ...	62 ...	·279
Total	35 ...	·908 ...	47 ...	·719 ...	71 ...	·498

To make this account more complete, results from several agronomic trials and observations carried out by the Department of Agriculture botanist, at Ukiriguru, have been included.

The summary of this season's trials with organic manures (Table 3) shows that in every case they have given a substantial direct increase in yield, followed by residual benefits now lasting up to six years from the time of application. The residual responses to the lighter dressings, three tons per acre, are not significant in the sixth year, and the response to a five tons per acre dressing appears to have disappeared in the eighth year.

(See Table 3 on next page)

TABLE 3

ORGANIC MANURIAL TRIALS—1949/50 SEASON — Ukiriguru Hill Sand

Treatment Yields expressed as a Percentage of the Control

Manure applied	1949/50 (Year of application)			1948/49 (First Residual Response)			1944/45 (Fifth Residual Response)		1941/42 (Eighth Residual Response)
Trial	13	V (a)	11 (c)	15	10 (c)	6 (b)	8	1	1
Crop	Cotton	Sorghum	Cotton	Cotton	Cotton	Cotton	Millet	Cotton	Cotton
Control-No manure	100%	100%	100%	100%	100%	100%	100%	100%	100%
Compost 3 tons/acre	—	—	115 (122)	—	—	128 (146)	107	—	—
F.Y.M. 3 tons/acre	—	—	—	—	—	—	116	—	101 (103)
Compost 5 tons/acre	—	—	—	131 (163)	118 (125)	—	—	—	—
F.Y.M. 5 tons/acre	—	—	—	—	—	—	—	132 (131)	—
Compost 6 tons/acre	172 (145)	195	121 (133)	—	—	—	—	—	-
Compost 7 tons/acre	—	—	—	—	—	—	125	—	—
F.Y.M. 7 tons/acre	—	—	—	—	—	—	142	—	—
Sig. Diff. ($P_{.} = \cdot 05$)	38%	41%	13%	19%	11%	19%	23%	21%	25%
Yield of Control (Seed Cotton or Grain in lb./acre)	377	426	428	449	414	607	685	274	361

NOTE :— Figures in brackets in all experiments are cotton stalk weights expressed as a percentage of the control—see text.

(a) Government Botanist's Trial.

(b) This trial is manured every third year i.e. 1945/46, 1948/49, 1951/52.

(c) Factorial Experiment—see text, and cf. Table 5.

F.Y.M. made under cover, and compost made in open "bomas" with a higher proportion of straw and crop residues, gave very similar results in the early years of Trial (8), but the former now shows greater residual benefits. In the two factorial trials included in this table, the "main effects", although equally significant, do not bring out the full magnitude of the increase in yield due to compost (cf. Table 5).

An interesting point has shown up in one trial with tie-ridging; tying has significantly increased the residual benefit from manure.

TABLE 4

Ukiriguru Hill Sand	*Cotton Stalk Weights—1950*	
	No Manure	*Manured 1948-49* (Compost 5 tons per acre)
Not tied (Control)	100%	128
Tied	92%	150
Sig. Diff. (P.=·05)	13%	

The value of organic manuring local agriculture is being stressed by the Agricultural Department; and with the increase in the extension staff some progress is being made. The lasting effect of a single application should be a strong inducement to manuring—if it can ever be got across to the African cultivator!

Compost and single superphosphate last year gave very similar responses in Trials (6) and (10); in Trial (6), the phosphate content of the compost treatment was very much lower than that of the superphosphate.

The suggestion was made that phosphate might be the important constituent in compost, and, becoming available gradually from year to year, that it played an appreciable part in the residual benefit. (Previous trials with rock phosphate and silicophosphate had given only small responses. But the effects of the latter have tended to increase rather than decrease—eighteen per cent above control this year in a factorial trial, from 400 lb. per acre applied in 1947-48).

The picture this year is somewhat different. (Table (5). Trial (6) still shows a higher yield from 300 lb. per acre of single superphosphate than from three tons of compost, with the superphosphate representing the higher phosphate application; but result from Trial (10), and the three new trials put down this year, with dressing equivalent on the basis of phosphate content, still leave the major part of the organic responses unexplained. For rather rough comparison, the amount of phosphate has been taken as equivalent in :—

45 lb. triple superphosphate
100 lb. single superphosphate
3 tons compost.

TABLE 5

ORGANIC MANURE AND PHOSPHATE

Ukiriguru Hill Sand.

1949/50 Yields expressed as Percentages

Trial No.	13	* V	† 11	† 10	6
Crop	Cotton	Sorghum	Cotton	Cotton	Cotton
Manure applied	1949-50	1949-50	1949-50	1948-49	1948-49
Control	100%	100%	100%	100%	100%
Single Supers 100 lb./acre... ...	—	—	—	99 (101)	—
Triple Supers 45 lb./acre	—	—	99 (107)	—	—
Compost 3 tons/acre	—	—	115 (122)	—	128 (146)
Compost 5 tons/acre	—	—	—	118 (125)	—
Single Supers 200 lb./acre ...	116 (108)	—	—	103 (103)	—
Triple Supers 90 lb./acre	—	149	96 (112)	—	—
Compost 6 tons/acre	172 (145)	195	121 (133)	—	—
Single Supers 300 lb./acre	—	—	—	—	133 (160)
Sig. Diff. (P.=·05)	38%	41%	13%	11%	19%

NOTE :— Figures in brackets in all experiments are cotton stalk weights expressed as a percentage of the control.

* Government Botanist's Trial.

† Factorial Trial—cf. Table 6.

Trial (13), and the Botanist's trial with sorghum (V), were intended to compare the usual method of applying compost and phosphate in the drill, with "reinforcing" the compost heap before application. There was little difference between these treatments; the reinforcing with phosphate was done only shortly before applying the compost—earlier incorporation in the compost heap would have been desirable. These trials, on very poor land, are however a striking example of the effect of compost. The mixture of compost and phosphate (half rate of each) gave results intermediate between the two manures by themselves.

In previous years, nitrogen and potash have had little effect; the nitrogen had been applied at the time of planting. Sulphate of ammonia was applied this season in February in Trial (11), shortly before flowering started; the results are given in Table 6.

(This trial was designed with four replications, but an unexpectedly heavy storm just after the application of the organic and phosphate treatments, before the ridges were built up, resulted in surface wash between plots, affecting two of the replications so seriously that they have to be discarded).

TABLE 6

Ukiriguru Hill Sand. Trial 11—Weight of Cotton Stalks per plot in lb.

Factor	Alone	Third Factor at zero average over three levels of			"Main Effects" averaged over all Treatments	
		N	P	D		
N0	67	—	99	120	130	100%
N1	108	—	139	143	152	116
N2	136	—	136	151	159	122
P0	67	104	—	120	138	100%
P1	118	130	—	134	148	107
P2	111	139	—	136	155	112
D0	67	104	99	—	124	100%
D1	134	151	134	—	151	122
D2	160	159	158	—	165	133
Sig. Diff. (P. ·05) =...	45	26	26	26	15	11%

Manures applied 1949-50

Level	N Sulphate of Ammonia	P Triple Supers	D Compost
1	125 lb./acre ...	45 lb./acre ...	3 tons/acre
2	250 lb./acre ...	90 lb./acre ...	6 tons/acre

The first point to note is the big increase in plant weight from nitrogen; secondly, that nitrogen this year applied in February, on very exhausted land, was as important a factor as phosphate; thirdly, that the correct combination of the two can give results about equal to compost in the year of application. These results are not reflected in the seed cotton yields; this is attributed to the loss of crop caused by the American Bollworm attack.

The problem of explaining satisfactorily the residual effects of organic manuring at Ukiriguru remains. While phosphate can be expected to be liberated in the soil over a period of years, it seems unlikely that organic nitrogen can remain effective in these soils for so long.

It is probable that all these results, and possibly the land resting results, are influenced by a seasonal build-up of nitrogen in the soil as reported from Kawanda by Griffith and Manning—probably varying from year to year with the distribution of the rain. A follow-up of such determinations from Ukiriguru would be very valuable.

Residual effects, of the same order as those from organic manures, have been noted from a very heavy dressing of cotton seed ash; yield from this treatment, in the sixth year after application, is equal to that from seven tons per acre of compost; but in January-February these ash plots were outstandingly better than any other treatment (Trial 8, Table 3). The crop was millet: differences were largely evened out before harvest.

The soaking of cotton seed in nutrient solutions before planting had little effect certainly nothing of the order reported from experiments in India. There is an indication that a dry dressing with superphosphate might be of some value: this will be followed up when time permits.

Ridging and Tying: The effects of tie-ridging on the Ukiriguru Hill sands have not shown up quite so strikingly this year (with a well distributed rainfall) as in some years; but nevertheless, in the main the benefits to cotton are very well worth while. In one trial, now in its fourth year, not manured—well made tied ridges against poor ridges not tied—the yields are 435 lb. and 387 lb. of seed cotton per acre—an increase of twenty-two per cent (stalk weights fifty-nine per cent). The millet yield was the same in both treatments; early in the season growth was better on the tie-ridged plots, but this difference evened out before harvest.

The further trial laid down last year gave no significant differences in seed cotton or stalk weights as a result of better ridging or tying; the effects of tying on the manured plots in this trial have already been referred to—Table 4.

Ridging the two Lubaga soil types ("ibushi" and "ibambasi") has increased the yield in three of the trials running there, while in the fourth trial there is little difference. On the "ibambasi" the increase was more than 100 per cent. There was no difference in yield between different sizes of ridges (3, 4 and 5 feet), nor between tied and not tied.

On the other hand ridging on the Ukiriguru "mbuga" resulted in a significant depression in yield of cotton and grain (Table 7). The African cultivator plants his crop on the flat on such soils.

TABLE 7

"Mbuga"

Yields in lb. Seed Cotton or Grain per acre.

Crop	Trial 17		Trial IX *		
	Cotton	Sorghum	Sorghum	Sorghum	Sorghum
Flat	139	707	555	1,165	1,135
Ridged†	75	475	530	780	850
Sig. Diff. (P.=·05) ...	54	51	N.S.	310	280

* Botanist's Trial : a trial with 3 varieties of sorghum.
† 3-foot ridges—not tied on "mbuga" soil.

Note

The cotton was late planted and lost crop heavily from American Bollworm attack: early in the season the flat was markedly the better grown.

Ploughing: The whole question of land treatment, especially the treatment of the heavier lands, has become important as a result of the introduction of mechanical cultivation: investigation is very much needed. Ploughing of "mbuga" (valley bottom) soils—perhaps more especially "mbuga" that has been cropped for a number of years, such as at Ukiriguru—may well be largely a matter of weed control, and if this is satisfactory, additional cultivation can apparently reduce yield. In preliminary observations by the Botanist

this season, ploughing of the Ukiriguru "mbuga" compared to a light hoeing, resulted in around a twenty per cent drop in grain yield. On the other hand, weed growth on these soils can be extremely heavy, and they cannot be worked during wet weather when weed growth is at a maximum.

Further preliminary trials discussed with the Regional Assistant Director of Agriculture, Lake Province, will be attempted this coming season; there will be further evidence from contrasting treatments in at least the one mechanized area in the Kwimba district.

Weed Control: The importance of weed control is shown in Tables 8 and 9. These are preliminary trials and they will be followed up in the coming season. The differences are large. (*Tridax repens* is the most troublesome weed on the hill sand soils).

TABLE 8

Ukiriguru—Hill Sand—Trial 20—Cotton.

Treatment	Weeding Dates	Yield in lb. Seed Cotton per acre.*	
1. Early weeding and then normal weeding	21st January, 2nd Feb., 1st March, 24th March ...	260	146%
2. Early weeding only... ...	21st January	68	38
3. Normal weeding	2nd Feb., 1st March, 26th March	178	100%
4. Normal weeding, leaving Tridax	2nd Feb., 1st March, 26th March	102	57
5. Late weeding only	1st March, 26th March ...	75	42
6. Late weeding, leaving Tridax	1st March, 26th March ...	42	23
Sig. Diff. (P.=·05)		29	16%

*These yields are exceptionally low, due to American Bollworm, Bacterial Blight, and Jassid damage on the cotton strain used.

TABLE 9

*Ukiriguru—"Mbuga"—Trial IV—Dobbs Sorghum.

Treatment	Weeding Dates	Yield in lb. Grain per acre	
Early weeded twice	29th Dec., 27th February ...	2,250	104%
Early weeded three times ...	29th Dec., 3rd Feb., 1st March	2,170	100%
Late weeded once	3rd February	1,015	47
Late weeded twice	3rd February, 1st March ...	1,225	57
Sig. Diff. (P.=·05)		370	17%

* Botanist's Trial.

Ridge Splitting: Weed control probably plays an important part in the yields from ridging as compared with flat cultivation. Poorly made ridges, and ridges used a second season without splitting in the usual way, show increased weed growth. The yield of millet from ridges was twelve per cent down on that of split ridges, and cotton stalk weights were twenty-four per cent down. (The cultivator always splits and rebuilds his ridges before planting—even if sometimes indifferently).

Rotation: The first results from a rotation trial started last year show that bulrush millet following a cotton crop has yielded fourteen per cent (significant) more than millet following millet. A duplicate of this trial has been put down at Lubaga this year, testing cotton and grain in simple rotations against continuous cropping of each.

Cotton Breeding

As has already been mentioned, the dominant feature of the season was the heavy American Bollworm attack, from fairly early in March onwards, developing seriously in April, into May. In the "mbuga" (valley-bottom) trials probably somewhere around two-thirds of the possible crop was lost; on the hill trials less, but probably at least one half. It was at the same time a year of heavy jassid attack. The strange behaviour, and therefore the trial results, have to be viewed in the light of this insect damage. It was unfortunate that in a year of heavy jassid attack (highly valuable in the sorting it allows in the breeding work) the middle and top crops of the jassid resistant strains were taken by American Bollworm—for the jassid susceptible material there was no top crop to lose.

At Lubaga the American Bollworm attack was light, but there was also appreciable jassid damage. Thus the relative yielding of the strains at Lubaga make an interesting comparison to Ukiriguru yields.

The cotton breeding results for the season, as shown in strain trial yields and the spinning test results, are very interesting, and satisfactory. Good yield improvements over MZ.561 are shown in the trials. There is probably, in the Ukiriguru strain trial results, a great value showing from early maturity, and a free-bolling habit, than would show in a year without serious American Bollworms. But these are both safe characters.

UK.46 has shown up as a worth-while issue, much superior in jassid resistance to MZ.561. It gins out somewhere around 1·5 per cent better than MZ.561. The ginning percentages shown in tables ten and twelve are optimum through a small gin.

UK.48 is distinctly better yielding than UK.46, and has much the same ginning percentage.

From spinning reports—for which we are indebted to the Shirley Institute—though no improvement on MZ.561 can be expected, except perhaps in more uniform quality, there should be little change in spinning quality from the substitution of UK.46 for MZ.561, or, later, UK.48 for UK. 46. (See Table 12, page 209).

TABLE 10

MZ. 561. UK. 46. UK. 48.—1950 SEASON.

	Ukiriguru Hill Trial			*Ukiriguru "Mbuga" Trial*			*Ukiriguru (Nyashimba) Trial* (Poor soil conditions)			*Lubaga "Ibushi" Trial*		
	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561
Mz. 561	601	32·4	100	365	32·0	100	319	32·0	100	630	31·7	100
UK. 46	651	34·0	113	370	34·0	108	468	34·6	159	742	33·6	125
UK. 48	714	35·0	128	400	33·9	115	537	34·5	181	897	34·1	153
A. 2,106 *	–	–	–	–	–	–	348	33·2	120	–	–	–
A. 5,851 *	–	–	–	–	–	–	417	34·7	142	–	–	–
Sig. Diff. (P.=.05) ...	92	–	17	77	–	22	119	–	40	146	–	26

* ex Barberton.

TABLE 11

B.C.I.R.A. SPINNING RESULTS.

Small Scale Spinning Tests (B.C.I.R.A.) : replicated material from trials 1949 and 1950

	1949 Ukiriguru Hill Trial		*1949 Shinyanga Trials*		*1949 Trials Ukerewe and Uzinza*		*1950 Ukiriguru Hill Trial*	
	Corrected lea count x strength product	Yarn appearance	Corrected lea count x strength product	Yarn appearance	Corrected lea count x strength product	Yarn appearance	Corrected lea count x strength product	Yarn appearance
MZ. 561 ...	1,889	F.G.	2,029	F.G.	1,846	F.G.	1,800	F.G.
UK. 46 ...	1,876	F.G.	2,070	Fair	1,806	F.G.	–	–
UK. 48 ...	1,867	F.G.	1,995	F.G.	1,873	Fair	1,840	F.G.
A. 2,106 ...	1,657	Fair	1,664	Poor	1,910	Fair	-	–
MU8A ...	1,812	Fair	1,829	Fair	1.781	Fair	–	–

In Table 12 are given yield trial results from some of the best of the newer strains developed since the issue of UK.48. Those included are all at least average or better for jassid resistance in the resistance classification—strains showing less than such average resistance are discarded; and in so far as we have gone they are at least average for resistance to Bacterial Blight.

From what is known of their lint and spinning qualities they seem likely to be acceptable. There are no reports as yet for the 3/28 material. Spinning reports on the 1950 lint are needed.

The 6/318 lots, fairly early and free fruiting, would be expected to show up well in such a season. 6/320 and 6/322 are cousin strains to 6/318. 5/57 and 6/318 were constituents of UK.48. The other two constituents of this issue, 6/29 and 6/41, have shown up as less satisfactory, 6/44 especially showing field and spinning defects. 4/86 was a component of UK.46.

It is hoped that an UK.51 will be issued for multiplication at the end of this 1950-51 season. It will be from such material as shown in table twelve that it will be constituted.

A heavy winnowing of material was possible during the season. For 1950-51, some 680 lots are being grown—not counting introduced lots; 130 are in the Ukiriguru trials, and many are also in the Lubaga, and District trials.

A start is now to be made crossing within this Ukiriguru material, to combine the outstanding qualities of the different lots. Further a start is to be made crossing with "Albar", the most valuable bacterial blight resistant stock obtained from Dr. J. B. Hutchinson at Namulonge.

The Central American lots from Dr. J. B. Hutchinson, suffering from both jassid attack and bacterial blight, and rather late planted, were very unhappy indeed. Little seed was recovered from them.

Pests and Diseases

Jassid (*Empoasca* spp.): In the susceptible "local" strips in the strain trials at Ukiriguru and Lubaga, and in susceptible material, there was heavy jassid damage. As already mentioned it is unfortunate that, at Ukiriguru, the heavy American Bollworm damage masked yield differences that should have shown up between susceptible and resistant lots. In the strain trials, the jassid bombardment from strips of susceptible "local" between replications, gave a severe test to the material. There has been considerable discarding for insufficient resistance. UK.46 under bombardment showed signs of cracking, but in general cultivation in the districts it showed markedly better than MZ.561; and had it not been for the American Bollworm damage this should have been reflected more distinctly in the yields. The contrast between the resistance of UK.46, and the susceptibility of MZ.561, where their zones joined, was impressive. UK.48 showed up as distinctly more resistant than UK.46.

TABLE 12

YIELD RESULTS—1950 STRAINS TRIALS.

	Ukiriguru Hill Trial			*Ukiriguru "Mbuga" Trial*			*Ukiriguru (Nyashimba) Hill Trial* (Poor soil conditions)			*Lubaga "Ibushi" Trial*		
	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561	Yield Seed Cotton lb. per acre	Ginning %	Lint % to MZ. 561
Mz. 561	601	32·4	100	365	32·0	100	319	32·0	100	630	31·7	100
ex 5 57												
7·7 ...	654	36·4	122	385	35·0	115	391	34·8	133	865	33·7	153
ex 6 318												
7 251 ...	853	34·0	149	465	32·0	127	–	–	–	1,031	33·0	171
7 254 ...	794	34·4	140	465	34·0	135	–	–	–	845	33·9	143
ex 6 320												
8 290 ...	–	–	–	–	–	–	613	34·2	206	–	–	–
8 291 ...	–	–	–	–	–	–	504	36·0	177	–	–	–
ex 6 322												
7 287 ...	899	34·3	158	535	34·0	155		–		935	32·3	151
8 333 ...	–	–	–	–	–	–	434	35·8	149	–	–	–
ex 4 86												
7 314 ...	775	36·4	144	480	35·2	144	–		–	965	35·4	171
ex 3 28												
7,139 ...	–	–	–	–	–	–	522	33·0	169	–	–	–
7 141 ...	–	–	–	–	–	–	596	34·5	202	–	–	–
7 142 ...	–	–	–	–	–	–	591	34·8	202	–	–	–
ex L4 112												
7,367 ...	798	33·3	136	445	33·0	126	406	32·1	127	906	34·4	156
Sig. Diff. P.=·05	92	–	17	77	–	22	119	–	40	146	–	26

American Bollworm (Heliothis armigera): The very heavy damage by American Bollworm has already been mentioned. The general circumstances of the loss appear to be that much of the cotton in the Province was exceptionally late planted. Because of serious food shortages some maize was planted at the earliest opportunity; there was then a considrable general planting of maize in early-mid December. There was egg-laying on this maize in the second half of February, and some egg-laying on cotton at the same time. The main egg-laying on cotton developed early in April. There was continuous loss of buds, squares, and bolls, in April into May

This 1950-51 season the planting of maize has been discouraged until after mid-January.

Stainers (Dysdercus spp.) : Stainer damage at Ukiriguru was about average. The percentage of Grade C seed cotton was ten per cent—twenty per cent. In the Lake-shore District Plots the percentage of Grade C was much as usual, in general around five per cent. In the Maswa District Plots the percentage was around thirty-three per cent. In Kwimba district there were reports of heavier staining than usual. The percentage of Grade C from District Plots there was around fifty per cent.

At Lubaga in spite of a routine poison application at the end of May—probably too late—the percentage of Grade C was around fifty per cent. The stainer poisoning experiments at Lubaga gave no worth-while information. If possible they are to be continued.

Aphis and Lygus: Both these pests were unimportant.

Bacterial Blight: (Xanthomonas malvacearum) : This past season a fair amount of work was done on bacterial blight on the Ukiriguru strains. Quite heavy loss was caused at Ukiriguru and in the districts, especially on susceptible material growing poorly on poor land. All the main Ukiriguru strains were grown in a special block, and were sprayed three times with suspension: as were the 1949 single plant selections in the selfing section. Records of attack were kept; and the lots were graded for degree of attack. Results are confused. Even BAR 7 8, B_2B_3, showed large angular leaf spots, and a percentage of the plants (fourteen per cent) showed, at one time or another, stem lesions.

The general conclusion reached was that under the Ukiriguru conditions of this year, fully susceptible lots could be picked out and discarded; the resistance of the B_2B_2 lots was entirely insufficient against a bad attack; that there may be differences in resistance within B_2B_2 material, but probably not at this stage of the work worth much following up; and that even the B_2B_3 strain—though the best of the material graded—showed stem lesions.

The main approach now must be, through a hybridizing programme, the introduction of resistance from "Albar".

It is a pleasure to record the co-operative working with Botanist, Department of Agriculture, who is developing the food crop work from Ukiriguru.

There is at all times close contact with the Regional Assistant Director of Argiculture, and his Provincial staff, on the extension of Ukiriguru findings, and the multiplication of seed stocks in the Province. There is the reciprocal benefit to Ukiriguru in being in touch with the problems of the field, and the difficulties of application.

Programme for 1950-51

The general approach remains as in the past few years—a continuation of the cotton breeding programme, and as much agronomic investigation, of importance to the cotton growing areas, as can reasonably be attempted.

The main addition to the cotton breeding work will be the start of a hybridizing programme, crossing within the Ukiriguru known strains, and crossing with "Albar", the Bacterial Blight resistant strain of Allen.

The manurial and fertiliser trials and the resting and agronomic trials continue. A further trial, on weeding effects on cotton, has been added.

Some simple preliminary experiments on "Mbuga" treatment are to be attempted—as the recent scanty labour force permits—to provide much-needed information for the tractor and extension work in the Province.

The cotton selection and testing—still a large part of the work of the Station continue as before.

The extension work at Lubaga and in the District Plots continues.

J. E. Peat,
Chief Scientixc Officer
(E.C.G.C.),
UKIRIGURU, FELA.

Origin and Special Characteristics of the Main Cotton Strains Mentioned

Lake Province "Local".—The commercial cotton of the Province prior to the issue of MZ. 561—mainly of Uganda Local Origin.

MZ. 561.—A straight selection from "Local", first multiplied in season 1939-40; the seed stock now being replaced by UK.46.

UK. 46.—A seed issue with fair Jassid resistance, first multiplied in the 1946-47 season; made up of the four best Lubaga strains, available at that time.

UK. 48.—A seed issue made up of four strains, 5/57, 6/29, 6/44 and 6/318, of better Jassid resistance than UK.46, and with some blackarm resistance; first issued for the 1948-49 season.

5/57.—A derivative of 3/17, itself a straight selection from "Local".

6/29.—ex 2/388, itself a derivative of MZ.561.

6/44.—A derivative of 3/17, itself a straight selection from "Local".

6/318.—ex 4/35, itself a derivative of MZ.561.

3/28.—Direct cut of MZ.561.

4/86.—ex 1/45, ex MZ.561; a constituent of UK.46.

6/320.—ex 4/33, itself a derivative of MZ.561;

6/322.—cousin strains to 6/318.

L4/112.—A Lubaga strain, ex Mz.457.

A. 2106.—A Barberton strain, U4 x Cambodia: now the standard strain in cultivation in the Barberton district.

A. 5851.—ex Barberton: MU8A x BH.52[2]: a promising parent at Barberton.

MU8A.—A Malwa Upland strain selected by Dr. J. B. Hutchinson: the seed was obtained from Barberton.

"Albar".—A general term for a group of selections from Allen, highly resistant to Bacterial Blight: ex Dr. J. B. Hutchinson.

ANNUAL REPORT OF THE SENIOR RESEARCH OFFICER, MLINGANO, NGOMENI

Touring.—During the year over seventy visits were paid to sisal estates, some in company with the staff of Messrs. Pest Control, Limited. The Senior Research Officer made four journeys to Dar es Salaam in connection with meetings of the Sisal Board and certain Government Committees. He also attended one meeting of the Kenya Sisal Board in Nairobi and visited the High Level Sisal Research Station, Thika. By arrangement with the Tanganyika Sisal Growers' Association, the Senior Research Officer participated in the task of valuing ex-enemy sisal estates which occupied a considerable part of his time from May until September. Two visits were made to the Central Line and in December a short period was spent in the Southern Province with the Temporary Scientific Assistant from Lyamungu investigating bole rots of sisal.

The Plant Physiologist went to a number of estates on the Tanga Line in order to examine deficiency diseases of sisal and to collect material from certain external trials. He also made some use of the library at Amani.

Routine quarterly visits to the external trials on the Central Line were carried out by the Agricultural Assistant in charge of field experiments in addition to working on trials situated in the Tanga district.

Buildings.—1950 represents a notable year in the history of the Station since an important building programme which was started in late 1949 was virtually completed during the year. This has greatly enhanced the facilities for research.

Five modern houses were erected for the European staff and a new wing was built on to the house occupied by the Senior Research Officer. There are now nine houses at Mlingano. In addition three laboratories and a new office block were constructed, making a total of four laboratories and two office buildings. Structural alterations were made to the original office to provide room for the library. This work was carried out by the contractors, Messrs. A. Trump & Co., Ltd., Tanga, and at beginning of the year progress was hampered by a water shortage.

The Station itself made a few minor improvements such as laying stone paths, building plinth walls, levelling the quadrangle between the laboratories, planting lawns, hedges, ornamental shrubs and trees. The slit trench below the soil erosion plots was also completed. All existing buildings were maintained in good order and the camp was re-thatched.

Water Supply.—Each house depends upon a 12,000 gallon underground rainwater tank for its water supply. A steel tank of 56,000 gallons capacity for the storage of rainwater was erected at the head of the citrus valley. A small electrically controlled pumping plant nearby together with a service tank behind the main buildings were also installed. This system provides water for the laboratories. The main tank filled during September, since when the supply has proved satisfactory.

The dam previously empty, only filled to nine feet six inches deep in May and the level of the water was low by the end of the year. Run-off was never great owing to an absence of heavy downpours combined with a low water-table in the soil resulting from the 1949 drought.

Electricity and Gas.—Two of the new houses and one laboratory were connected with the present electric supply line. An Aerogen gas plant together with all necessary piping was delivered in November and was later installed in a separate building by the contractors who also laid the mains to the laboratories. It will not be possible to generate gas until extensions to the H.T. power line are completed next year since the gas plant is driven by electricity.

Equipment.—Considerable quantities of laboratory equipment, ordered through the Crown Agents for the Colonies, were delivered during the year. Besides chemicals and glassware some of the larger items included a Spekker Absorptiometer, a Cambridge P^H testing outfit, electric and vacuum ovens, an electric muffle furnace and balances. A dark room was built into one laboratory and a refrigerator was purchased for photographic work. The principal needs of each laboratory have now been covered to a large extent.

Machinery.—New agricultural machinery acquired during the year comprised a diesel wheeled tractor, a disc plough, a trailer and a dam scoop. The Station already possesses a crawler tractor and a small range of implements. The rubber-tyred tractor is useful for working on external trials.

Library.—The Station subscribes to several scientific and agricultural journals and past numbers have now been bound into volumes locally. In addition numerous text-books were purchased during the year. Considerable progress has been made with card-indexing over 3,000 references to published articles according to the Universal Decimal System of Classification.

Clearing and Planting Work.—Twenty acres of heavy bush were cleared in the northern section of the Station. This area and another field of fifteen acres were afterwards sown with maize in order to provide food for labour. A fair crop was obtained.

Weather.—Resulting from the unprecedented drought of 1949, the Station was extremely parched and dry during the first two months of 1950. The main rains broke early in March and a favourable growing season was experienced for the rest of the year except for a dry spell in June. The total rainfall amounted to 43·5 inches, which is not far short of the average for the past fifteen years, and it was well distributed over 160 days. Such conditions helped the establishment of new trials and fostered the growth of sisal and other crops.

The total number of hours of sunshine recorded decreased slightly compared with 1949. Wind measured during January, February and December was about twice as great as that for the other months of the year.

Field Trials on the Station.—Twenty-two experiments are now in progress at Mlingano and six on outside estates. These are mostly of complex designs and involve the recording of 1,751 separate plots. They are mainly concerned with the cultivation of sisal, spacing, spacing combined with cutting, severity of cutting, mulching, manuring, rotating with fallow crops, comparison of agave hybrids and the use of fertilisers, growth promoting substances and insecticides in bulbil nurseries.

Among the most important trials at Mlingano are those sited on land which has grown sisal continuously since 1936. In the cultivation trial which compares the effects of six degrees of weeding varying from clean weeding to no weeding, the third cycle sisal on clean weeded land is now most unthrifty. It will be recalled that during the first cycle on virgin land this treatment resulted in the fastest growth and the best yields. Fibre yields during the second cycle declined to the order of about three tons per hectare. At present it appears very problematical whether any crop at all will be obtained from the third cycle. This sisal is approaching three years old but it is suffering from a number of deficiency diseases including "banding disease". The soil is low in organic matter and has lost structure through prolonged exposure. Sisal subject to weed competition, whether restricted or not, has grown more slowly largely due to competition for soil moisture. It is in varying stages of development but for the most part is healthy. That buried under weeds is bearing light, flaccid leaf having a low fibre content and the sisal is far from ready for cutting despite being three years old. Leguminous cover crops in sisal spaced in single rows have not been conspicuously successful, especially in recent years, and they do not appear to have arrested a decline in soil fertility.

The nitrogen and phosphate manurial trials which date back to 1936 were cut out early in the year. The third cycle sisal was three years old and its growth was unsatisfactory. The results of a first cutting taken before these trials were terminated failed to show any residual effects of fertilisers applied during the previous two cycles. Analyses kindly carried out by the East African Agricultural and Forestry Research Organisation, Amani, indicated that the soil was low in calcium and phosphate; the pH varied from 4·8 to 5·1. These trials have now been replaced by a grass rotational and manurial trial wherein dressings of lime, nitrogen, phosphate and potash have been applied separately and in every combination to plots of elephant grass *(Pennisetum purpureum)*, guinea grass *(Panicum maximum)*, and newly planted sisal. Half of the number of grass plots were fenced and have been grazed by cattle. From July onwards the grasses made exellent growth and during the early stages showed marked responses to phosphate and nitrogen. These responses become less evident after the grasses were either grazed or cut down to provide a soil mulch. The sisal tends to be straggly and uneven due to heavy weevil damage. The effects of the grass leys and manuring will not be known until the plots are ploughed and replanted with sisal again.

Heavy poling was expected this year in the fertility trial which was started in 1944. Good yields were obtained from this large sisal growing on virgin land. The opportunity was taken to cut out the sisal and this has enabled the introduction of twelve different rotational systems comparing continuous sisal growing, with and without strips of soil cover, besides testing the use of elephant grass and green manure crops (manured and unmanured), an erect legume *(Tephrosia candida)* and natural vegetation. The period of resting varies from two to three years. The growth of the young sisal planted this year, although marred by weevil damage, suggests that the fertility of this land has not yet become heavily exhausted. It is therefore hoped that certain of the following treatments may arrest a possible decline in fibre yields during the second cycle and point to a way of "farming" sisal. Strips of a recumbent leguminous cover crop *(Calapogonium mucunoides)* sown in young sisal planted in double-rows are now providing a perfect soil cover; the growth of the cover crop was favoured by well distributed rains. The erect leguminous crop is about four feet tall Although it is deep-rooted and shades the soil, the amount of leaf-fall is relatively light and does not afford much protection for the structure of the top soil. The green manure crops were sown twice and ploughed in; the quantity of green matter was not heavy while repeated ploughing has brought about some breakdown of soil structure The soil was also exposed for too long particularly during the hot season. At present it appears that green manuring is unlikely to be very beneficial to the soil. The plots of natural vegetation comprise an almost pure stand of "ukoka" grass (*Panicum trichocladum*), which is not obnoxious, and there has not been much bush growth. Once again the elephant grass responded to artificial fertilisers. This is a long term experiment and the effects of the various rotations cannot be ascertained until the results of the second cycle of sisal are known.

A fertiliser placement trial was started on sisal worn land. Nitrogenous, phosphatic, and potassic fertilisers are under test and each has been applied to young sisal planted in double-rows in a different manner such as close to the plant, beneath the plant, broadcast and applied to the grass strip only. This sisal has suffered badly from weevil damage. It is too early to report any results except that the placement of phosphate below the plant before planting appears to be important particularly on the red acid "fixing" soils at Mlingano.

The Factorial Manurial Trial which was replanted in 1949 is now eighteen months old. The treatments comprise dressings of lime, nitrogen, phosphate and potash in every combination and each at three levels—none, moderate, and heavy rates. Leaf counts show small responses to nitrogen and phosphate and certain of these plots may be ready for cutting when they are two years old. Calcium has generally brought about an improvement in the colour of the sisal and reduction of chlorotic mottling of the leaves which is proportional to the rates of dressings. Nitrogen has had an adverse effect in this respect, particularly when applied by itself

and also potash in some cases. The heavy dressing of phosphate helped to reduce chlorotic mottling but this has not been observed with the single dressing.

In the Mulching Trial, now two years old, all the plots treated with sisal waste, cotton seed, coconut cake, cut elephant grass or artificials have grown slightly better than the control (no mulch). Those receiving sisal waste have unfurled about nine leaves per plant more than the control.

The Ridging Trial was cut for the first time this year when it was two years old. The ridged sisal, having grown a little faster than that planted on the flat, gave rather higher yields. Post-cutting manurial treatments were applied.

The main rains maize, sorghum, and bean crops interplanted between single and double row sisal in the Interplanting Trial did fairly well and showed responses to fertiliser treatments. Competition for moisture was not so marked this year and the sisal was not checked to a great extent except in the sorghum plots. These suffered most during the drought last year.

The spacing trials continue to show that the population of plants per hectare is much more important than the actual distance between the plants. The spacing × cutting trial, which was replanted in 1949, has grown satisfactorily and the low density (4000/Ha.) plots tend to be most forward. Weevil has damaged a number of the largest plants.

High density (6000/Ha.) sisal in the Severity of Cutting Trial which has been cut drastically every six months since it was eighteen months old has now become distinctly dwarfed compared with that cut more leniently. Its leaf which tends to be a pale green, is shorter and lighter but it is not yet possible to tell the effect upon fibre yields. Conversely low density (4000/Ha.) sisal cut lightly for the first time at an age of 2½ years has borne long heavy leaf and is beginning to pole. This trial confirms previous findings which pointed to commencement of cutting constituting an important factor affecting yields; any delay means loss of crop and lower fibre percentages in later cuttings.

Plants cut severely and frequently from the 30th leaf stage onwards have never recovered and are extremely stunted. This suggests that while early onset of cutting is desirable, cutting should not be too drastic.

It may be noted from another trial that excessive trimming of the leaves of transplants at the time of lifting from the nursery seriously retards the growth of young sisal. The effects can still be seen in the field although the experiment was planted nearly three years ago. Trimming of roots or depth of planting did not affect growth markedly.

A bulbil nursery manuring and spacing trial, repeated for the second time on the same site this year is showing responses to sisal waste applied at the rate of 50 tons per hectare as well as to wide spacing (50 × 25 cms.). As far

as can be judged at present fertilisers have not influenced growth very much while nitrogen alone appears to have depressed growth. Old sisal waste provides an ideal mulch and to date weevil damage has been practically absent.

The Plant Physiologist has put down a number of bulbil trials testing various root promoting substances in combination with insecticides. Promising results were obtained in the laboratory but it is too soon to report on the field experiments which were purposely planted during a dry period later in the year.

Bulbils collected from forty selected Agave hybrids were raised in nurseries last year. They have now been planted in two trials comparing them with common sisal. One trial had a most unfavourable start owing to the drought but the hybrids survived a long period of desiccation better than ordinary sisal which had to be replanted. Contrary to expectations, the hybrids have not suffered from extensive weevil damage.

External Trials.—The spacing × cutting trial which has been in progress near Kilosa since 1944 may finish next year because heavy poling has occurred in the 1000 Ha. and 5000 Ha. density plots. Satisfactory fibre yields have been obtained to date. The trial has a good ground cover of *Glycine javanica*.

The sisal in a similar trial in the Morogoro district has not made such swift growth. It tends to be variable and the plants are rather small and yellowish. This is partly due to failure to establish a soil cover after two years of clean weeding.

The sisal in another spacing × cutting trial which has been conducted on a coastal estate near Tanga since 1945 had made such uneven growth that it was decided to end the experiment this year. Plant losses caused by the weevil and bole rot were heavy and it became clear that the experiment would not afford very precise information on the spacing and cutting of sisal in this locality. The sisal was uprooted and the trial has now been replaced by a grass rotational manurial experiment of a half-plaid design. Strips were planted with elephant grass, guinea grass and sisal and fertilisers were applied to all three crops. Good rains helped in the establishment of the grasses which showed definite responses to nitrogenous and phosphatic manuring. The elephant grass grew strikingly well and sampling revealed that the average weight of fresh green vegetable matter returned to the soil was ninety tons per hectare, some plots yielding up to 1,950 tons per hectare. These plots were cut down before the small rains. The sisal has made patchy growth.

A manurial trial started in 1947 on an estate in the Tanga district was cut for the second time when the sisal was less than three and a half years old. The experiment is sited on a piece of land where "banding disease" of sisal is prevalent. This is a deficiency disease associated with a shortage of potash. The sisal in all the unmanured plots now exhibits severe symptoms of banding disease and has yielded about two tons of fibre per hectare over two

cuttings. Phosphate alone had little effect upon the progress of the disease, and nitrogen none at all, but potash succeeded in remedying the disease. The overall response or extra crop obtained from a cumulative dressing of 600 lb. of sulphate of potash per hectare, was 1·36 tons of fibre and costings figures suggest that potassic manuring of this order on such areas would be economic.

A ridging × manurial trial was put down on a waterlogged calcareous black clay on an estate near Pangani. The sisal is still small but it has shown a definite response to ridging. Once again potash remedied banding disease although nitrogen has tended to aggravate the complaint.

Later on in the year a manurial trial was started in the Pare district where the rainfall is apt to be low and erratic. Utilisation of sisal waste as a mulch forms one of the treatments.

Planting Physiology.—The Physiologist continued studies of the nutrition of sisal using the techniques of plant injection, rapid tissue tests, chemical analysis of plants tissues, and sand culture.

Plant injection again showed negative results when used on plants older than one year. The uptake of nutrients has, however been observed on nursery plants. Tissue tests indicated that leaves having banding disease symptoms had much lower concentrations of potassium than healthy leaves. An examination of the distribution of potassium along the leaf showed that the concentration of potassium in the leaf bases is normally lower than in other regions of the leaf. These tests also indicated that chlorotic mottling of leaves is associated with low calcium contents. The phosphate content of leaves tends to vary very widely and attempts to correlate this with purple leaf tip roll have proved unsuccessful so far

The ash content of leaves showing deficiency disease increases gradually from the base to about the middle region of the leaf and then remains fairly constant sometimes falling off towards the tip. That for healthy leaves increases more rapidly and shows less falling off towards the tip of the leaf.

Sand culture work using bulbils which are supplied with known concentrations and combinations of plant nutrients is in progress. It may take several months before deficiency symptoms appear even though the plants were starved initially by being grown for several weeks in pure sand.

Bole Rot Investigation.—Mrs. M. M. Wallace of the Plant Pathology Laboratory, Lyamungu, carried out some valuable work investigating several different manifestations of bole rot in sisal which were occurring in various parts of the Territory. These included "wet bole" rot, which usually begins in a cut leaf base on the side of the plant and has a pungent smell; dry basal bole rot which spreads upwards from the special base of the bole and has a musty odour; and a dry rot in the middle section of the bole which does not kill the plant since it often forms aerial roots which enables the crown to

continue growth. The fungus *Aspergillus niger*, van Tiegh, was isolated from the first two types and it is highly probably that the third type is attributable to the same fungus. The fungus is not a highly parasitic one and usually it can only gain entrance to the plant through a wound.

The Station followed up this work by carrying out inoculation trial using a pure culture of *A. niger*. The fungus was inoculated on to freshly cut leaf bases of upper or lower leaves, and on plants which were cut lightly or heavily. Differences due to severity of cutting and the site of inoculation were not significant but the number of "takes" in the inoculated plants varied from 74·5 to 97·9 per cent compared with no rotting in the control plots.

Entomology.—Little work was done under this section since Messrs. Pest Control, Ltd., are studying the sisal weevil and methods for its control.

Fibre Testing.—During 1950 fibre testing was confined chiefly to analysing the distribution of fibres by length and determining their fineness of single leaf samples taken periodically from the Fibre Characteristics trial. Here the plants are in varying stages of development due to cutting effects.

Citrus.—Supplies of budded citrus trees were restricted this year owing to the 1949 drought and only 6,489 trees were sold to sisal estates and other purchasers. 15,000 rough lemon seedlings were planted out and budded in preparation for the 1951 season and these have made excellent growth due to better rain. The citrus nurseries are given dressings of cattle manure regularly.

Livestock.—The small herd of Zebu cattle maintained on an indoor system in fly-proofed byres has outgrown the accommodation available and plans have been approved for extending the cattle shed. Losses of newly-born calves due to various causes were rather heavy but there were no cases of *trypanosomiasis* One bull, past his prime, died and has been replaced temporarily by another raised on the Station. The five animals which have been used out of doors in the grazing trial have kept healthy so far.

Planter's Day.—Planter's Day, 1950 was the most successful yet held and the attendance was nearly two hundred visitors. The exhibit of diagrams, models and specimens showing the progress of experimental work was on a larger scale than before. This also included a display of manufactured sisal products kindly provided by Messrs. Irish Ropes, Limited. Talks were given by the Plant Physiologist and Mr. D. G. Ashby, of Messrs. Pest Control, Limited.

Publications and Advisory Correspondence.—Half-yearly progress reports were submitted to the Mlingano Management and Research Committee and these were circulated to all sisal growers by the Tanganyika Sisal Growers' Association. One article by the Senior Research Officer and two articles by the Plant Physiologist were written for the projected Sisal Journal. A large volume of advisory correspondence was dealt with by the staff throughout the year.

Malarial Control.—The Malarial Research Unit, Muhesa, has continued to assist in malarial control on the Station. Trees of *Lagerstroemia speciosa* planted near the water's edge of the dam have grown well but they have not been subjected to prolonged inundation.

East African Agriculture and Forestry Research Organisation.—The Station has always maintained close contact with the East African Agriculture and Forestry Research Organisation, whose Director, Dr. B. A. Keen, F.R.S., is a member of the Mlingano Management and Research Committee. Advice and assistance in the layout and statistical analysis of trials, soil analyses, botanical identifications, and planting material is gratefully acknowledged. The Organisation continues to have the use of a plot at Mlingano where cassava hybrids are tested for resistance against mosaic and brown streak virus diseases. The Fertilisers Experiments Team conducted two manurial trials with maize on the Station.

Visitors.—Visitors to the Station during the year included Sir John Russell, F.R.S., R. A. Frost, The British Council, Nairobi; Dr. H. J. Page, C.M.G., Principal, Imperial College of Tropical Agriculture, Trinidad; Dr. Norman Wright, Chief Scientific Adviser to the Ministry of Food and Chairman of the Colonial Agricultural Research Committee; Dr. H. H. Storey, F.R.S., East African Agricultural and Forestry Research Organization, Nairobi; D. Akenhead, O.B.E., Director, Commonwealth Bureau of Horticultural and Plantation Crops, East Malling, England; W. L. Gorell-Barnes, C.M.G., Colonial Office, London; R. W. R. Miller, C.M.G., A. M. A. Karimjee, O.B.E., M.L.C., Adam Karimjee, E. F. Hitchcock, C.B.E., C. A. Bartlett, C.B.E., B. O. Moore, W. D. C. Walgreve, and Dr. A. Kortleke, Agricultural Adviser to the H.V.A., Holland; R. A. van der Sluis, Holland; Dr. O. A. Dewilde, Director, Expt. Station, University of Louvain; A. Israel, R. V. Holme, and A. Lacey, A.E. and C.I. Ltd., Nairobi; Dr. W. E. Ripper and O. W. Snow, O.B.E., Messrs. Pest Control, Limited, Cambridge; R. Gavin and M. Breye, I.L.O., Geneva; Prof. W. M. Macmillan, St. Andrew's University, Scotland; A. S. P. Neish, London; P. A. Feer, Zurich; G. N. Doyle, London; L. Mackie, London; H. Markwalder, C. S. Bridges, London; C. E. J. Biggs, Director of Agriculture, J. R. P. Soper, Deputy Director of Agriculture; C. J. McGregor, Regional Assistant Director of Agriculture; Snr. O. T. Mendes Sobrinho, Snr. R. Miller Paiva, and Snr. O. F. de Souza, of Brazil; Count Stucky de Quay, Lisbon; M. M. J. Vervcoutere, Belgium; Barn de Beck, Lisbon; R. L. Dalal, Uganda; E. A. Hitchcock, London; Dr. C. C. Webster, Assistant Director of Research, Kenya; Dr. F. Schofield, Zanzibar; E. Pawson, Northern Rhodesia; C. W. Burnett, London; F. Sykes, England; Clyde Higgs, England; E. Thompson, Dar es Salaam; A. Reiman, L. R. Doughty, Kenya; A. Walter, East African Meteorological Service; R. F. Barker, P. R. Hesse, R. F. W. Nicholas, Amani; C. J. Edwards, Sudan; H. G. Faulkner; Z. G. Caccimatis, S. Emmanuel, W. Hunter,

Accounts.—The accounts of the Station were taken over by the Secretary/Accountant, Tanganyika Sisal Growers' Association as from 1st July, 1950. The Station staff assisted in preparing inventories and valuations of fixed and other assets.

Acknowledgments.—The Station is indebted to Messrs. Noorani Plantations Limited, for continuing to provide decorticating facilities at their Ngomeni Estates whenever required. Thanks are also due to many other estates for their ready assistance in connection with external trials.

G. W. Lock,
Senior Research Officer

ANNUAL REPORT OF THE BOTANIST, UKIRIGURU, FOR THE YEAR 1950

A. UKIRIGURU

Sorghum Improvement

Selection Work.—The main aim is to obtain an early maturing sorghum with a palatable grain, which stores well, and yields well. Resistance to striga and stalk borer are also being looked for.

Storage.—1,078 re-selections, and 225 first selections were tested for resistance to weevil attack by the method of placing 100 grains in net bags in a bulk of weevily grain, and counting the damaged grains at fortnightly intervals. These tests were quite satisfactory this year.

Wiru (a good storer) and P.41 (a bad storer) were used as controls in each tin, and by the time that the P.41 had more than fifty per cent of damaged grain, the Wiru had only five per cent or less. On this standard, selections which had lost five per cent or less were classified as very good, and numbered 327, while those which had lost six per cent to ten per cent were classified as good, and numbered 321. The original selections were made in the field by looking for a hard pearly layer in the outer endosperm: all which showed any signs of this were taken for tests, and it is interesting to note that forty-nine per cent were assessed as good or very good, while of the remaining fifty-one per cent, only fifteen per cent were as bad as P.41. It seems that looking for the pearly endosperm in the field, followed by simple storage tests gives a practical method of selecting for resistance to weevil damage.

When microscopical equipment is available it may well prove possible to identify good storers from sections of the grain.

The 639 selections which stored well have been reduced to 515, those with poor panicles being discarded.

Length of Maturity.—Small variety trials were carried out on the district plots, using four varieties, (1) P.41, 3 to 3¼ months maturity, (2) Dobbs, 4½ months maturity, (3) Bukura Mahemba, 5 months maturity, (4) Ng'hollongo Tembe, over six months maturity period. These trials will be repeated for several years, to gain some indication of the most suitable length of maturity. Results are shown below :—

Mean Yield, lb/acre

Plot	P. 41*	Dobbs	B. Mahemba	Ng'hollongo Tembe	Mean	Sig. Diff. P=·05, in lb./acre
Lubaga	1,030	1,575	1,575	1,375	1,390	405
Butulwa	375	1,645	1,280	735	1,010	395
Ilula	245	560	475	215	375	165
Kitunga	155	385	360	260	290	145
Mabuki	190	750	1,235	1,315	870	235
Somanda	755	1,705	1,110	95†	900	430
Luguru	315	660	955	40†	485	230
Variety Mean ...	440	1,040	1,000	575	—	

*P. 41 was planted at the same spacing as the other varieties. At a closer spacing, yields would probably have been some 20% greater.
†Not included in the analysis.

Extracts from experiments on Ukiriguru (details of which are in section 4, Experimental), show the following yield differences :—

Experiment I	P. 41	1,660 lb./acre
	Martin (3½ months maturity)	1,710 lb./acre
	Dobbs	2,810 lb./acre
	B. Mahemba	2,020 lb./acre
Experiment II	P. 41	1,420 lb./acre
	Plainsman (3½ months maturity) ...	2,100 lb./acre
	3 D. Shallu varieties 3½-4 months) ...	2,200 lb./acre
	Dobbs	2,900 lb./acre

It is impossible to separate length of maturity effects from the inherent potential yield of the variety, but P.41 looked very unhappy in most of the district plots, and while no definite conclusions can be drawn until results are available over a period of years, it may be better to try to obtain early maturing sorghums of from three-and-a-half to four months maturity period, rather than the very early three months types, as the extra two to four weeks would not reduce greatly their usefulness to the African, and might allow of a better and more consistent yield.

It is interesting to note that, with some varieties at least, growing conditions influence length of maturity. Thus, at Butulwa plot, the P.41 was ready for harvest at the same times as Dobbs, although it gave less than a quarter of the yield. At Ukiriguru this season, Wiru varieties which usually take six months to mature were ready to harvest after five months.

Plant height.—Differences in weed growth under the three types of sorghum in experiment I were noticed, which were probably due to differences in the intensity of shade.

The experiment was weeded a week after the Dobbs had been harvested, and the weeds weighed. Only the heads of P.41, Early Hegari, and Martin had been harvested, and tillers were still growing strongly, so that harvesting

made little difference to the shade under these varieties, and will not account for the differences in weed cover. Figures are given below :—

Weight of Weeds in lb.

Spacing	3′×3′	3′×2′	3′×1′	3′×6″	3′×6″×2 rows	Total
Variety						
E. Hegari ...	631	462	465	391	351	2,300
P. 41	300	397	365	281	233	1,576
Martin	490	301	316	208	162	1,477
Dobbs	168	62	62	44	40	376
Bukura Mahemba	32	49	25	29	29	164
Total	1,621	1,271	1,233	953	815	5,893

Early Hegari, P.41, and Martin were about three feet high, and tillered freely. Dobbs was about six feet high, with some tillering.
B. Mahemba was eight feet high, with very little tillering.

Evidently the taller sorghums suppressed weed much more effectively than the short ones, and plants of five to six feet high will be selected in preference to those three feet high in the breeding work. The scientific staff at Kongwa state that sorghums of the height of Dobbs can be harvested by combine quite easily, and there seems to be no objection to concentrating on sorghums of medium height, rather than the short and the tall types.

In view of the observation recorded in the foregoing paragraphs, a "hot-pot" of twenty-three selections has been mixed up and planted for selection work, in the hope that they will hybridise and give useful new combinations. The selections chosen were three and a half to four months maturity, four to six feet in height, and rated as very good for storage, very good for panicle size, and all appeared to have palatable grains. They originated from quite distinct varieties.

Striga resistance.— Unexpected evidence of big differences in susceptibility to Striga has been obtained this year. The relevant figures are summarized below :—

*Experiment I**	*Actual records Striga Count (totals)*	*Transformed data, log means*	*Test for Transformed data. Sig. Diff. (P.=·05) for log means.*
Variety			
Early Hegari	200	1·59	—
P. 41	272	1·65	0·28 for comparison other than Martin.
Martin	899	2·19	—
Dobbs	122	1·36	0·30 for comparison with Martin.
Bukura Mahemba ...	1,078	2·27	—

Number of Striga plants per acre on Dobbs 405.

* *Note on the Striga analysis of Experiment I.*

The range in figures as they stood was too great for a straightforward analysis, and Block I showed a highly irregular distribution of Striga. On Dr. Yates advice, a logarithmic transformation was done, and Block I omitted from the analysis. In addition, one sub-plot of Martin in Block II had an extremely high Striga count relative to the other sub-plots in the block, so the missing plot technique was applied to the log values, which accounts for the higher significant difference for comparisons involving Martin. The tests for significance may only be made against the log-values, and not on the untransformed data.

Dobbs has significantly less Striga than the other varieties excepting Early Hegari, at P = ·05. It is only just significantly different from P.41 at this level.

Experiment II Variety	*Untransformed* Mean Striga count	*Transformed* Log mean Striga count	*Test for transformed data* Sig. Diff.
Dobbs	3·0	0·74	—
P. 41	29·4	1·24	0·21 (P. = ·05)
Early Hegari	26·4	1·22	0·29 (P. = ·01)
D. Shallu 5,463-34	40·5	1·34	—
D. Shallu 5,463-37-3	47·7	1·33	—
D. Shallu 5,631-12	40·2	1·47	—
Plainsman	41·5	1·68	—

Number of Striga plants per acre on Dobbs 244

Here, Dobbs has a lighter infestation of Striga than the other varieties, at P = ·01.

District Plots.—The usefulness of Striga counts was not noticed sufficiently early in the season for counts to be arranged on all the plots, and counting was started late on those recorded.

Untransformed data, Striga totals

Plot	P. 41	Dobbs	B. Mahemba	Ng'hollongo Tembe	Striga plants per acre on Dobbs
Mabuki	237	74	1,658	5,933	1,190
Somanda	177	996	3,947	4,946*	16,100
Luguru	60	105	476	474*	10,185
Lubaga	2	7	460	372†	125
Butulwa	0	0	41	351†	Nil

Transformed data, log, Striga totals

Plot	P. 41	Dobbs	B. Mahemba	Ng'hollongo Tembe	Sig. Diff. (P. = ·05)
Mabuki	8·64	4·56	14·48	17·89	2·64
Somanda	8·47	11·77	16·88	—*	3·46
Luguru	5·83	7·34	11·10	—*	1·30

*Ng'hollongo Tembe at Somanda and Luguru plots was not included in the analysis, as the stand was 50% at Somanda, and 25% at Luguru. Calculated on the basis of Striga per plant, the infestation on this variety would be higher than that shown.

†Lubaga and Butulwa were not analysed, as there were so many zero recording for the Dobbs and P. 41 plots.

The figures given above suggest that Dobbs and P.41 may possess a higher degree of resistance to Striga infestation than a variety such as Bukura Mahemba. It is noticeable that at Ukiriguru and Mabuki (fifteen miles south of Ukiriguru) Dobbs is less heavily infested than P.41, whereas in Maswa district (Somanda and Luguru) the position is reversed. Whether this is due to differences in soil type, or to a different strain of Striga, remains to be discovered.

Taking all the varieties recorded, there seems to be a correlation between Striga infestation and length of maturity. Dobbs, however, is an exception to this, and may have some resistance. This variety is popular in some areas,

but in many places the flour from it is regarded as being too bitter. Dobbs has also been known to fail completely at Ukiriguru owing to drought between flowering and harvest, and a reduction in the length of maturity might lessen the risk of this occurring, as the break in the rains is often February and the first half of March. Selections from Dobbs, mainly of slightly earlier maturity, but some with better grains, are being carried on, and an attempt will be made to obtain types combining a better Striga resistance with a more palatable grain.

The cross Dobbs × D.D. Shallu was made last year with these objects in view, and the F1 generation grew well, and was selfed. The hybrid plants were of the same length of maturity as Dobbs, about 18 inches taller, and were very vigorous with numerous tillers. The grain very closely resembled that of Dobbs, the Shallu type grain being recessive. The F2 generation may give useful segregates, either for immediate use or as parents for another cross on to Dobbs.

Stalk Borer.—Figures of counts of the number of heading shoots damaged by stalk-borer are given in the following table :—

Experiment I

Totals of damaged shoots

Spacing	3′×3′	3′×2′	3′×1′	3′×6″	3′×6″×2rows	Variety totals
Variety						
E. Hegari	62	68	108	109	127	604
P. 41	84	80	133	136	168	341
Martin	64	56	63	59	105	367
Dobbs	69	68	63	63	102	457
B. Mahemba	62	68	82	83	124	194
Spacing totals	341	340	449	450	626	2.206

Experiment II

Mean damaged shoots per plot

Dobbs	322
P. 41	188
Early Hegari	151

District plots

Plot	P. 41	Dobbs	B. Mahemba
Kitunga	96	95	124
Mabuki	19	39	61
Ilula	134	239	218
Total	249	373	403

These figures have not been analysed, as they are not consistent. Thus, P.41 has almost twice the count recorded for Dobbs in Experiment I, whereas in Experiment II, which was in the same field, Dobbs has twice the borer count of P.41. Overall, P.41 may be slightly less attractive to borer than Dobbs, and B. Mahemba slighty more attractive, or else the maturity period may account for the differences, the longer-term B. Mahemba being able to rear more borers than the early P.41. At any rate, there is nothing to suggest varietal resistance to a worth-while extent, and the stalk borer problem is unlikely to be solved by breeding work. Nothing satisfactory has resulted from a lot of American attempts to breed stalk-borer resistant types.

Introductions.—At the time of writing, 227 new types have been received for observation. The majority of these are Tanganyika types, and the assistance which members of the Department have given in collecting them is much appreciated. The introductions include a few which are alleged to show resistance to Striga, and some grain types new to the station. Of the latter, a Milo type called "Kifaru" (from Shinyanga) has a very big grain, which can be used in the preparation of "Masangu", a food usually made from maize. This grain type may have a future in areas where maize is marginal, but popular, particularly as the large grains are said to be less liable to damage by small birds.

Sorghum Experiments

(Further details of the experiments in the section are given in Appendix I). All trials were on mbuga soil unless otherwise stated.

Experiment I: Variety and Spacing Trial.—This trial was laid down to determine the optimum spacing for different styles of sorghum, for while a good deal is known about growing the long and very long term Native types, which are mainly tall, nothing is known about the agronomy of the short-strawed, short-term sorghums. The varieties of sorghum used were :—

		Maturity period (approx.) *Days*	*Height feet*
(1)	Early Hegari	90	3
(2)	P. 41	100	3
(3)	Martin	110	3
(4)	Dobbs	130	5–6
(5)	Bukura Mahemba ...	150	8

Types (1)—(3) produced a second tiller harvest, and the figures given below are of total yield :—

Grain yields in lb./acre

Spacing	3′×3′	3′×2′	3′×1′	3′×6″	3′×6″×2 rows	Variety Mean
Variety						
Early Hegari ...	710 ...	950 ...	1,320 ...	1,370 ...	1,940 ...	1,250
P. 41	1,260 ...	1,390 ...	1,730 ...	1,730 ...	2,180 ...	1,660
Martin	980 ...	1,360 ...	1,740 ...	1,960 ...	2,580 ...	1,710
Dobbs	2,080 ...	2,510 ...	3,120 ...	3,020 ...	3,310 ...	2,810
Nukura Mahembe...	1,790 ...	1,830 ...	2,280 ...	2,180 ...	2,000 ...	2,020
Spacing Means ...	1,360 ...	1,590 ...	2,040 ...	2,050 ...	2,400 ...	—

Sig. Diff. (P.=·05). Body of Table ... 230 lb./acre.
*Spacings ... 290 lb./acre.
*Tested against the Variety × Spacing interaction.

Grain yields as Percentages of Dobbs at 3′×1′ spacing

Spacing	3′×3′	3′×2′	3′×1′	3′×6″	3′×6″×2 rows	Variety Mean
Variety						
Early Hegari ...	22·5 ...	30·5 ...	42 ...	44 ...	62 ...	40
P. 41	40 ...	44·5 ...	55·5 ...	55·5 ...	69·5 ...	52·5
Martin	31·5 ...	43·5 ...	55·5 ...	62·5 ...	82·5 ...	55
Dobbs	77·5 ...	80·5 ...	100 ...	95·5 ...	106 ...	90
B. Mahemba ...	57 ...	58·5 ...	73 ...	75 ...	64 ...	64·5
Spacing means ...	43·5 ...	51 ...	65 ...	65·5 ...	77 ...	—

Sig. Diff. (P.=·05) Body of Table 7 ... 5%
Spacings 9%

These yields are good. The land was newly-broken mbuga, and the stand in all plots was excellent. It is evident that the three dwarf varieties give better yields with closer spacing, Dobbs is not significantly better at the 3′ × 6″ × 2 rows spacing than at 3′ × 1′, whereas with Bukura Mahemba, there are indications of a fall off in yield at spacings closer than 3′ × 1′. Information of this type is very important for variety trials, to compare the various varieties at the optimum spacing for the sorghum type to which they belong. The experment will need to be repeated for a number of years, to cover a range of seasons. Moisture is probably the factor which most affects plant growth on the mbuga, and one would expect the close spacings to show up better in years of well distributed rainfall, and the wider spacings to do relatively better in years with long dry spells. The final spacing decided upon must be that giving the most consistent yield over a number of seasons.

It is interesting to note the big increase in yield in the three varieties at a spacing of 3′ × 6″ × 2 rows (i.e., ridges 3′ apart, two rows per ridge, plants 6″ apart in the row) over the 3′ × 6″ spacing. Possibly with this type of sorghum, decreasing the distance between the rows as well as the distance apart in the row would give even better yields, in a good season.

Experiment II : Variety Trial.—This trial was a comparison of seven sorghums, of early or medium maturity. The same spacing was used for all the varieties, which means that Early Hegari, P.41, and Plainsman were not at their optimum spacing, and quite possibly the D.Shallu varieties would have yielded better at a closer spacing. The varieties were as follows :—

	Maturity	*Height feet*
(1) Early Hegari	90 days approximately ...	3
(2) P. 41	100 days approximately ...	3
(3) Plainsman	110 days approximately ...	3
(4) D. Shallu 5,463-34	120 days approximately ...	4
(5) D. Shallu 5,463-37-3	120 days approximately ...	4
(6) D. Shallu 5,631-12	120 days approximately ...	4
(7) Dobbs	130 days approximately ...	5—6″

Grain Yields in lb. per acre

E. Hegari	*P. 41*	*Plainsman*	*D. Shallu 5463-34*	*D. Shallu 5463-37-3*	*D. Shallu 5631-12*	*Dobbs*
1,250 ...	1,420 ...	2,100 ...	1,830 ...	2,010 ...	1,960 ...	2,900
43% ...	49% ...	72·5% ...	63% ...	70% ...	67·5% ...	100%

Sig. Diff. (P.=·05). 475 lb./acre 16·5%

This experiment was in the same field as Experiment (1), and yields correspond quite well with those shown for the 3′ × 1′ spacing in that experiment for Early Hegari, P.41 and Dobbs. In both of these experiments, Dobbs has shown that it can give a very good yield. The D.Shallu varieties in Experiment II have given quite satisfactory yields, but there have been indications that they do not stand drought well in other parts of the Territory this year, and here in 1948-49. They have open panicles, a grain which stores quite well, and the O.F.C. at Urambo consider them promising. These varieties, or selections from them, may help to supply the need for a short-term

sorghum with a fairly good grain, although further trials are necessary before distributing them. All the varieties grew well, and field notes recorded no important points except that the grain on E. Hegari, P.41 and Plainsman was discoloured due to mould whereas the D.Shallu grain was very clean, and the Dobbs quite clean.

Experiment III. Time of planting.—This experiment was carried out on hill land. Planting dates were :—

(1) December 26th, 1949.
(2) January 23rd, 1950.
(3) February 22nd.
(4) March 20th (approximate—records incomplete).

The March planting gave no yield at all, and the February planting yielded so badly that it was not included in the analysis. The varieties used were Dobbs, P.41 and Early Hegari.

Grain yields lb./acre

Variety	December	January	February	Mean	Mean of December and January plantings only
Dobbs	970 ...	300 ...	14 ...	428 ...	635
P. 41	770 ...	220 ...	11 ...	334 ...	495
E. Hegari	550 ...	200 ...	13 ...	254 ...	375
Mean...	763 ...	240 ...	13 ...	— ...	—

Sig. Diff. (P. = ·05). Body of Table, December and January planting only = ·25 lb. per acre
Sig. Diff. for December and January Means = ·335 lb. per acre.

These figures afford a striking illustration of the damage which *Atherigona* can do in late planted sorghum. This pest lays its eggs in the funnel of the young plant, when from 6 inches to 18 inches high, and the larvae eat out the growing plant, causing the plant to tiller, and the tillers are attacked when they have reached a suitable stage, causing more tillering. *Atherigona* is responsible for the major part, if not all, of the difference in yield between the January and December plantings. It was very serious in the February plantings, and so delayed heading in the March planting, due to the constant tillering before a lucky shoot got away, that no yield at all was obtained. Its effect may be exaggerated in this experiment owing to plants in different stages being very close to one another, but in areas where *Atherigona* is prevalent, it is doubtful whether it is worthwhile planting sorghum after the end of January. This is a very important point where the short term sorghums are concerned, as it limits their usefulness as a quick crop to be grown in the reliable March-April rains in years when the earlier rains have failed. It is hoped to continue this experiment for a number of years, and to do counts of the *Atherigona* damage.

Experiment IV. Weeding trial.—This trial was an exploratory, one and the following treatments were given :—

	Dates of Weeding
(1) Early weeded twice	29/12/49 and 27/2/50.
(2) Early weeding continued for 2 months	29/12/49, 3/2/50 and 1/3/50.
(3) Late weeding only	3/2/50
(4) Late weeding for 2 months	3/2/50 and 1/3/50.

Grain yield in lb./acre

Treatment	(1)	(2)	(3)	(4)	Sig. diff.
	2,250 ...	2,170 ...	1,015 ...	1,225 ...	370 (P=·05 510 (P=·10

The sorghum was 4 inches high at the early weeding, and 2 feet high at the late weeding. The weed growth was very light at the time of the early weeding, and heavy in the late weeded plots at their first weeding, mainly *Commelina* spp. The difference in the appearance of the plots was most striking after a few days without rain, the sorghum on the early weeded plots looking healthy, that on the late weeded plots having curled leaves looking very unhappy. At the time of the first late weeding (3/2/50) the sorghum was 4 feet high on the early weeded plots, and only 2 feet high on the late weeded plots. The height difference continued, although it was less marked at the time of flowering, which was only a few days earlier in the early weeded treatments than in those weeded late. No definite conclusions can be drawn owing to the extreme differences in weeding times, but the indication that earliness of weeding is more important than the number of weedings needs following up.

The experiment was repeated on hill lands, but there was no difference between the treatment yields, as the weed-growth was negligible for the first three months after planting. This illustrates the value of ridging on the hill land in suppressing weed growth.

Manurial trials. Experiment v. Reinforced compost.—This trial was a duplicate of one on cotton, and was done on hill land recently taken over from native cultivation, which had never been manured. The intention is to measure the effect of a combination of phosphate and compost, particularly the period of the residual responses. Treatments and yields were as follows :—

	Grain lb./acre	*Percentage*
(1) Control	427 ...	100
(2) Triple super-phosphate, 90 lb. per acre	636 ...	149
(3) Compost, 6 tons per acre	831 ...	195
(4) Compost, 3 tons per acre plus triple super 45 lb. per acre, mixed in the heap 6 weeks before applying	738 ...	173
(5) Compost, 3 tons per acre plus triple super 45 lb. per acre, mixed in the drill at the time of applying	631 ...	148
Sig. Diff. at P.=·05	175 ...	41

The significant differences are large, owing to the uneven ground on which the experiment was done.

The quantities of phosphate and compost were calculated to give approximately the same amounts of P_2O_5 per acre. Although the only certain responses are that all treatments were superior to the control, there may be an indication that the compost had a greater effect than the phosphate. The response to the mixture of the two in the heap is almost exactly what would be expected from their separate effects, whereas that from the manures mixed in the drill is less than would be expected, although these differences are not significant, and therefore firm conclusions cannot be drawn. These differences are much smaller in the straw weights. (See Appendix I).

Experiment VI. Seed soaking comparisons.—This trial was a comparison of pre-soaking of seed in water, ammonium sulphate, single and triple super-phosphate solutions, and dusting the seed with single and triple super-phosphate powders. All treatments depressed the yield below the control, especially the soaking in triple super-phosphate, which gave eighteen per cent of the control yield. No further experiments of this type will be done.

Experiment VII. Farmyard Manure on Mbuga land.—The experiment was a simple two treatment comparison of F.Y.M. at five tons/acre against control, duplicated two sorghum varieties. Yields were as follows (grain, lb./acre) :—

Variety	*F.Y.M. 5 tons/acre*	*Control*	*Significant at*
Dobbs	1,800 ...	... 1,610 ... (5 replications)	... N.S.
Bukura Mahemba	1,090 ...	... 970 ... (6 replications)	... N.S.

There were no obvious growth differences during the season, and the smallness of both visible and yield response suggests that there would be little point in continuing this trial at the present stage of the work.

Cultivation Trials. Experiment VIII. Ploughing on the Striga Trial.—Two strips of the Striga trial were ploughed and ridged in the normal way, two more strips were planted on last year's ridges, with no pre-cultivation. The results are shown below :—

Grain yield in lb./acre (Bukura Mahembe)

	Weeded	Not Weeded	Mean	Percentage (Mean)
Ploughed	820 ...	80 ...	450 ...	100
Not ploughed	1,065 ...	230 ...	650 ...	144
Mean	945 ...	155 ...	— ...	—
Percentage (Mean)	100 ...	16½ ...	— ...	—

The ploughed *v.* not ploughed difference is significant at $P = 0{\cdot}2$, which on only two replications may be real. This result is unexpected, and will be investigated further. Part of the effect may be due to a ridge *v.* flat difference, as the ridges on the unploughed strips were decidedly flatter than those freshly made on the ploughed strips, and this source of difference will be eliminated

in future trials. In view of the scheme for ploughing mbugas in Sukumaland, it will be important to know how often ploughing is necessary after the initial breaking-in. The deep-cracking of these soils in the dry season gives them a natural tilth when the rains come, and it may be that ploughing will only be beneficial at quite long intervals.

The simple comparison of sorghum weeded at frequent intervals against sorghum left after two early weedings for the Striga to build up in has been continued for a number of years. The difference this year was again big, and the amount of Striga in the unweeded plots was exceptionally large. The differences in the sorghum growth were very pronounced before the Striga appeared above ground.

There was no indication that ploughing was helpful in reducing the Striga, the indications being that the parasite did less damage on the unploughed plots.

The great importance of Striga is again emphasized by these figures, but the permanent trial to test the effect of various crop rotations and weeding practices cannot be started for another season as a sufficiently uniform or dense stand of Striga has not yet been built up on the plots to be used in the trial.

Experiment IX. Ridging v. Flat Trial.—This was a simple comparison of big three-feet ridges against flat cultivation. Both treatments were ploughed and harrowed, and the ridges were then made with a Ransome's "Sphere" ox ridging plough. The same spacing of plants was used on both treatments. Results were as follows :—(6 replications in all cases).

Variety	*Grain lb./acre*		*Per cent*		*Difference*		
	Flat	*Ridged*	*Flat*	*Ridged*		*Significant at*
Bukura Mahemba	555	530	105	100	...	N.S.
Dobbs	1,165	780	149	100	...	P.=·05
P. 41	1,135	850	133	100	...	P.=·05

Ridging appears to have had little effect on the Bukura Mahemba, but to have depressed the yield on the Dobbs and P.41. This trial was also done with Native Millet, Sunflower and Cotton on the Mbuga, but with these crops there was no difference in yield on the two treatments. The Chief Scientific Officer had also obtained evidence that ridging on the Mbuga depresses yield, and as he will be investigating the problem further, this experiment will be discontinued. Ridging is not practised by the African cultivator on Mbuga lands, and his practice of flat cultivation is probably sound.

Millets.—Six early maturing Pennisetum millets were grown in small plots, and showed promise. They were decidedly earlier than local native millet (a month earlier in some cases), and grew to a height of about four feet.

	Grain yield (lb./acre)	
Bajiri	600	These figures are multiplied up from small plots, and should be taken as comparative only.
Ameli	990	
Ifeti	980	
Bene Awned	770	
Red Awned	600	
Bulrush Quick	550	

Other Bulrush millets yielded as follows (lb./acre)

Indian long headed—860.
Local native— 500-900 (Figures from C.S.O.'s experiments

Awned bulrush millet was too mixed for an estimate of yield to be given.

These early maturing types will be given more attention next season, and will go into a variety trial.

Thirty selections of setaria millet and fifty-nine of finger millet (eleusine) were taken, for observation, but these types are likely to be of only very limited usefulness here. Panicum millet did well at the school, and also on Kingolwira Prison Farm, but yielded poorly again on Ukiriguru Farm. It will be kept for observation, and included in a trial, as its grain is certainly liked by Africans. It may prove to be a useful stop-gap in years of food shortage.

Legumes.—The soya beans looked less miserable this year, but still do not appear to be a promising crop for this area. Yellow Kadele (from Urambo) grew much better than any of the others in the collection, but the yield was not outstanding. Ogden (from Urambo) showed some promise, but the stand was bad. Innoculation will be tried next season, but plenty of root nodules were found this year.

Soya Bean yields in lb./acre

No. 29	215
No. 39	170
No. 55	190
No. 107	105
Ukiriguru	85
Lincoln	75
Yellow Kadele	210
C 2	180
C 4	260
C 8	195
C 17	105

Following a variety trial next season, the majority of these will be discarded. They have been grown on the Station for some years, and have never given a reasonable crop. Cowpea yields were poor, and a lot of damage was done b ythe parasitic weed *Alectra Abyssinica*. The land on which they were planted had not grown these legumes* since it was taken over from Native cultivation three years ago, yet the infestation by *Alectra* was very heavy indeed. If it is at all typical of native land, their cowpeas must suffer considerably. Yields (for what they are worth) of the better varieties were as follows :—

Lb./acre of seed per acre

Chora Cowpeas	500
Turiani No. 5	90
Turiani No. 7	180
Turiani No. 19	95

*Sunn hemp was grown in the first season, 1947-48

Velvet beans again grew strongly, but no haulm weights were recorded. This bean grows very well here, and is extremely drought resistant : it may eventually have a place as a fodder crop in Usukuma.

Sword beans *(Canavalia Ensiformis)* grew quite well, and survived the dry season without trouble, but the leaf production is poor, the stems quickly become woody, and the beans are of little use for food. They would only be worth growing if there was a market for the beans.

Tepary beans from Uganda looked very poor, yellowing early and yielding only twenty-five lb./acre of beans.

Sunflowers.—This crop was most disappointing. The selections taken last year produced very poor heads indeed, and those which had been chosen for a good oil yield were as poor as any. There seems to be little point in working with this crop until staff permits of proper self-pollination and crossing work.

Bulk yields on the Mbuga of a white seeded variety which has been on the Station for some years were 460 lb./acre of seed. Three varieties from Urambo were also grown, but were very mixed.

Sunflowers ex Urambo lb./acre of seed

Jupiter	500	Multiplied from small plots.
Pole Star	240	
Grey seed	325	

Cassava.—A yield trial including some of the Amani resistant cassavas gave very good results.

It was planted on hill land 8/3/48 and harvested 19/1/50. The land had been manured with ten tons/acre of compost in the 1946-47 season, so was in very good heart.

Variety	*Yield/acre of wet root In short tons of 2,000 lb.*	
Msitu Zanzibar	9·3	
4026/16 (Amani)	7·2	
Cassava from Ukerewe ...	6·9	L.S.D. (P.=·05) 1·6
Alpin Valenca (ex Congo) ...	6·9	
4026/20 (Amani)	6·8	
405/1 (Amani)	6·5	
4029/10 (Amani)	3·7	
Kalagala (Local, heavily infected)	2·4	

Kalagala is very heavily infected with mosaic, and is not a very representative local cassava. It would be optimistic to regard the yield differences recorded as due to absence of mosaic alone—Msitu Zanzibar and some of the Amani cassavas may well be inherently better yielders regardless of the mosaic. 4026/16, 4026/20 and 405/1 seem to be very resistant to mosaic, and bulks have been planted up for distribution in 1952. Msitu Zanzibar, Alpin Valenca and the cassava from Ukerewe evidently have some degree of resistance, but without rogueing and careful selections of planting material they would soon be infected, although I have yet to see a plant of these varieties showing symptoms as badly as Kalagala.

A new variety trial with nine varieties was planted in February, including the Liongo cassava from Tabora, which is a very bitter type unpalatable to pig and porcupine. Undoubtedly the Amani varieties are too sweet to be

of use in areas where these vermin are prevalent. Porcupine do quite a lot of damage to them here, in spite of night-watchmen on the fields, and the employment at intervals of highly ornamental porcupine hunters.

Clone rows were planted from Amani seedlings, interlarded with Kalagala to give mosaic a chance to spread to them. These will be studied in February, but already it is evident that there is some useful material among them, one of the progeny of forty-four showing very rapid growth indeed.

Scale is proving a trouble on the farm, and in spite of very thorough treatment of the cuttings as advised by the Entomologist, it has appeared in the new plantings, and may be difficult to get rid of, as any valuable material cannot be uprooted and burnt. Two experiments were done for the Entomologist to assist him in studying the scale and its control.

Systematic.—Mr. Luman sent in three batches of grasses for identification, and one batch was received from the Forestry Officer in Mwanza. Some collecting of grass and legumes has been done, but it has still not proved possible to settle down to this side of the work properly.

Mwabagole

General.—Difficulty was experienced in getting the rice planted in time. It was not possible to prepare the land before the rain on December 7th, and after that date, there were frequent hold-ups owing to the land being too wet. The manurial trials other than the first year residual trial went in late, and all the later planted rice which had to be carried on into the dry season showed a large proportion of empty ears. This season showed conclusively that rice grown in the dry season may set very badly, and give a poor crop.

Selection work.—906 re-selections were made from last year's selections, taken mainly on tillering (as an indication of yield) straw strength, and length of maturity. A certain minimum standard of grain quality (based on the shape of the grain) was set. None were taken which shattered readily. There was a range of nearly a month in the length of maturity of the selections from Kahogo.

One hundred and thirty-two were taken from introductions from other parts of the Territory, grown last season for the first time at Mwabagole. Some of this material looks promising. A large number of the selections made in 1949 and some of the introductions were discarded.

Experimental.—(Further details of trials are in Appendix II).

Variety trials.—The comparison of the 1946-47 selections from Kahogo was repeated, and gave the following yields :—

Selection	*Unhulled grain, lb./acre*	*Percentage of Kahogo*	*Percentage of Kahogo in 1949–50*
6/2	3,000	91	97
6/4	2,300	70	97
6/5	2,840	86	105
6/7	3,420	104	97
6/8	3,220	98	104
6/10	3,820	116	105
7/7	3,280	100	95
7/8	3,200	97	106
7/9	3,360	102	107
7/10	3,250	99	99
7/11	3,420	104	103
7/12	3,280	100	100
7/13	3,290	100	110
7/14	3,440	105	101
Kahogo	3,290	100	100 (4,180 lb./acre)
L.S.D. (P.=.05)	317	9·6%	7·6%

Numbers 6/10, 7/8, 7/9, 7/11, 7/13 and 7/14 have been retained for further trial, the remainder being discarded.

This season's Variety Trial yielded as follows :—

Variety	*Grain lb./acre*	*Percentage of Kahogo*
1/18 (ex Afaa Kilombero)	3,100	118
Kalyamani	2,900	110
2/5 (ex Afaa Mwanza)	2,890	110
B.C. 65	2,760	105
Kahogo	2,630	100
2/16 (ex Afaa Kilombero)	2,610	99
Afaa Mkoma	2,530	96
Afaa Mwanza	2,380	91
Sig. Diff. (P.=·05)	197	7·5%

Kalyamani, 2/5, B.C. 65 and Afaa Mkoma were not is the variety trial last year, but gave good yields in the small bulks. With the exception of Afaa Mkoma, they are worth closer attention, as they have quite good field characters. 1/18 is a very reliable yielder at Mwabagole, although its longer maturation period and very poor quality render it unattractive to the African.

It is interesting to compare relative yields in previous years :—

	1944	*1946*	*1949*	*1950*
1/18	147%	123%	117%	118%
2/16	—	142%	119%	99%
Afaa Mwanza	102%	97%	101%	91%
Kahogo	100%	100%	100%	100%
Kahogo, lb./acre	2,190	2,680	3,370	2,630

Manurial Trials

Residual effects.—Last year's trial of puddling in of green material was planted this season to Kahogo. No growth differences could be detected during the season, and the yield figures showed no indication of any residual

effect. The rice was healthy, with no empty ears. The control plots yielded 3,630 lb./acre of grain, and all the green material treatments were within four per cent of this figure, excepting the two tons acre of physic nut, which was six and a half per cent above the control yield. Pen manure, four tons/acre was eight and a half per cent above the control yield, but this was not a real difference.

Initial effects: Trial I.—This was a modification of last year's trial, an ordinary grass treatment being included instead of physic nut. The rice grew into the dry season, and there were many empty ears, a bigger proportion showing in the treated plots than in the control.

Treatment	Yields			
	Grain lb./acre	Percentage	Straw lb./acre	Percentage
Cassia 4 tons/acre	3,960	115	4,550	130
Cassia 2 tons/acre	4,050	118	4,640	132
Tree Cassava 2 tons/acre	3,890	113	5,650	161
Tree Cassava 4 tons/acre	3,860	112	3,810	109
Grass 4 tons/acre	3,610	105	3,820	109
Grass 2 tons/acre	3,800	111	3,390	97
Pen Manure 4 tons/acre	4,000	116	4,930	140
Puddled only	3,790	110	3,790	109
Control	3,440	100	3,510	100
Sig. Diff. (P.=·05)	N.S.	N.S.	673	19%

The fact that the increases in grain yield are not significant makes it impossible to draw conclusions, and the percentage increases are lower than in previous years, the empty heads being sufficient to account for this. The increases in straw weight corresponded quite well with figures from other years, and link up very well with the observations on growth during the season. The experiments in their present form are not satisfactory. Growth of plots near the pen manure treatment was suspiciously good. A certain amount of lateral seepage through the bunds is to be expected, and the present irrigation system is such that the overflow from one plot may go into another plot. This would be accentuated in years when the pump was used a lot, and would be less when the rice was rain fed. The irrigation system needs to be re-designed, and it would be better to omit the pen manure treatment. It is quite possible that the increases relative to control as measured are lower than should really be the case, unless the effect of seepage from the pen manure plots is equally great on all other treatments.

Trial II.—This trial was an attempt to compare a combination of puddled green material and pen manure against the two separately. The pen manure was either applied with the Cassia (immediate), or given as four equal dress-

ings broadcast on the plots at fortnightly intervals (four times). This experiment suffered from all the defects of the previous one.

Grain yield, lb./acre

	Cassia 0	*Cassia 2 tons*	*Cassia 4 tons*	*Mean*
Pen manure 0	2,420	2,750	2,510	2,560
Pen manure 2 tons/acre immediate	2,750	2,540	2,330	2,540
Pen manure, 2 tons/acre 4 times	2,600	2,630	2,540	2,590
Mean	2,590	2,640	2,460	—

None of the differences are significant.

Straw weights, lb./acre

	Cassia 0	*Cassia 2 tons*	*Cassia 4*	*Percentage*
Pen manure 0	2,600	3,320	4,140	100
Pen manure 2 tons, immediate	3,010	3,630	4,880	114
Pen manure 2 tons, 4 times	2,680	3,700	4,730	111
Mean	2,760	3,550	4,580	—
Percentage	100	128	166	—

The increase from the pen manure immediate treatment is just significant at P = ·05. The differences between Cassia 0 and Cassia 2, and Cassia 2 and Cassia 4 are both significant at P = ·01. There is no interaction.

Time of puddling in of green material.—In this experiment, Cassia at two tons and four tons per acre was puddled in twenty-eight, fourteen and one day before transplanting the rice. In the early stages of growth, the differences were pronounced, the plots receiving the Cassia one day before transplanting looking very poor, and the Cassia four tons transplanted after fourteen days looking worse than the Cassia two tons at fourteen days and the two and four ton dressings at twenty-eight days. These differences in growth gradually disappeared, until at flowering it was difficult to distinguish the treatments.

Grain yields

	1 day	*14 days*	*28 days*	*Mean*
Cassia 2 tons/acre	3,540	3,450	3,560	3,520
Cassia 4 tons/acre	3,490	3,150	3,440	3,360
Mean	3,510	3,300	3,500	—

None of the differences are significant.

Straw weights lb./acre

	1 day	*14 days*	*28 days*	*Mean*	*Percentage*
Cassia 2 tons/acre	5,060	5,240	4,950	5,080	100
Cassia 4 tons/acre	5,290	6,600	5,500	5,790	114
Mean	5,170	5,920	5,220	—	—
Percentage	100	114	101	—	—

The increase in straw weight of Cassia four tons/acre over Cassia two tons/acre is sginificant at P = ·01, and the fourteen days interval between puddling in and transplanting is better than the one day and twenty-eight days treatments at P = ·05. There is no interaction.

Summary of manurial trial results.—The interval between puddling in and transplanting had no effect on the final grain yield, although transplanting immediately following puddling in depresses growth in the early stages. An interval of fourteen days may be better than twenty-eight (straw weights). Trials over the last few years indicate that the puddling in of Cassia and Tree Cassava give a bigger increase in straw weight than pen manure, and the grain yields show a similar response in years when growing conditions are good, but differences were very much smaller this year, which can be fully accounted for by the lateness of planting. The effect of the green material is therefore unlikely to be purely a manurial N.P.K. response, and its extent may be underestimated owing to the likelihood of lateral movement of solutes from the pen manure plots.

Cultivation trials: weeding trial.—This trial compared early weeding (eleven days after transplanting) and late weeding (thirty days after transplanting). The field was clean at the time of transplanting. In each of these treatments, there were three intervals of weeding, once only, three times at monthly intervals (two months) and continuous at monthly intervals until harvest. Very little weed appeared in any of the treatments. This experiment was planted in good time, and no trouble from empty heads occurred.

Grain yield in lb./acre

	Only	*2 months*	*Continuous*	*Mean*	*Percentage*
Early weeding	3,290	3,300	3,290	3,290	100%
Late weeding	3,060	3,050	3,190	3,100	94%
Mean	3,125	3,125	3,240	—	—

The difference in favour of the early weeding is significant at P = ·01. There is no difference between the number of weedings, and no interaction.

It is hoped to repeat the experiment in a dirty field, where differences may be more pronounced.

In the original design of the experiment, a sub-treatment comparing hand pulling and hoeing of weeds was included, but the difference in yield was less than two per cent, and evidently not significant from the inspection of the figures, so it was omitted from the analysis.

Method of planting.—This trial was a comparison of transplanting, broadcasting on damp soil, drilling on damp soil, and broadcasting into water. The trial failed owing to the difficulty of water control, seepage from the broadcast into water treatment flooding the other plots, and resulting in very bad germination. It is hoped to repeat this, omitting the broadcasting into water treatment.

A simple observation on cutting back the rice sown after transplanting, in the hopes that it would induce more tillering and so give a higher yield, showed that the cutting resulted in a set-back from which the rice never really recovered.

Variety × Spacing × clump planting trial.—The object of this trial was to compare a rice variety which tillers freely (Kahogo) with one producing a fair number of tillers (Gamti) and one producing few tillers (Pishori). These were planted at spacings of six inches, one foot and one foot six inches, one, two and four plants per hole. It seemed possible that there might be some effect on yield at the different spacings, the clump planting compensating for the poorer tillering in Gamti and Pishoro. There was no evidence of this, but the experiment is probably worth repeating once more, as in other countries clump planting has proved to be worth-while. Pishori gave a main and tiller harvest. Yields were as follows :—

(A) Pishori first harvest only :—

Unhulled grain in lb./acre

	Kahogo	*Pishori*	*Gamti*	*Mean*
6in. × 6in.	2,670 ...	1,780 ...	2,590 ...	2,347
6in. × 1ft.	2,370 ...	1,690 ...	2,310 ...	2,123
1ft. × 1ft.	2,300 ...	1,560 ...	2,350 ...	2,070
Mean	2,447 ...	1,677 ...	2,417 ...	—

Kahogo and Gamti are superior at P. = ·01.

The 6″ × 6″ spacing is superior to 6″ × 1′ and 1′ × 1′ at P. = ·05, but there is no difference between the latter.

There are no interactions.

(B) Both harvests of Pishori.

Unhulled Grain lb./acre

	Kahogo	*Pishori*	*Gamti*	*Mean*
6″ × 6″	2,670 ...	2,280 ...	2,590 ...	2,513
6″ × 1′	2,370 ...	2,160 ...	2,310 ...	2,280
1′ × 1′	2,300 ...	2,000 ...	2,350 ...	2,217
Mean	2,447 ...	2,147 ...	2,417 ...	—

The conclusions are the same, but the superiority of the 6″ × 6″ spacing over the others is increased, and just fails to reach the P. = ·01 point over the 1′ × 1′ spacing. (F = 5·67 against 5·72).

There was no indication of any effect from the clump planting, so these figures have been omitted from the summary. One plant and four plants gave identical yields, two plants per hole was two per cent greater over all varieties and spacings, and there were no interactions.

Conclusions

(1) Clump planting had no effect.

(2) The superiority of the 6″ × 6″ spacing was clearly shown, but there was surprisingly little difference between the 6″ × 1′ and the 1′ × 1′ spacing.

(3) The yield of Gamti, which is a rice of good quality, was higher relative to Kahogo than expected. It was ready for harvest thirty-one days after Pishori harvest. The early maturity of the latter variety may be an important point in its favour: it will produce a crop seventeen days earlier than Kahogo, and if the season continues to be good will give a second harvest. The lower yield of the two harvests would be more than compensated for by the price in a free market (it is of high quality), and in bad years there is a much better chance of obtaining at least one harvest than there is with Kahogo.

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H. Dogget,
Botanist.

APPENDIX I

Experiment I: Variety × Spacing trial

Dry planted 10/11/49. Germinated 12/12/49

	Percentage germination *Per cent*	Final staand at harvests *Per cent*
Dobbs	60	96
Bukura Mahemba ...	65	97
Early Hegari	53	97
P. 41	58	96

Gaps re-sown: 17/12/49—21/12/49.
Thinned and transplanted: 6/1/50.
Weeded: 10/1/50; 18/2/50; 1/5/50 (Weeds weighed).
Harvesting: P. 41, E. Hegari, Martin. 4/4/50 + 24/4/50.

Dobbs	24/4/50
B. Mahemba	12/6/50

N.B. Harvesting was governed by the weather, and the dates shown are not an accurate measure of length of maturity.

Comparative yields, first harvesting only, of E. Hegari
P. 41 and Martin
Grain in lb./acre

	3′×3′	3′×2′	3′×1′	3′×6″	3′×6″x 2 rows	Mean
E. Hegari ...	425	560	915	1,030	1,550	896
P. 41	680	810	1,105	1,250	1,760	1,121
Martin	435	635	900	1,145	1,790	981
Mean	513	668	973	1,142	1,700	—

Experiment II: Variety trial

Dry planted 11/11/49. *Germinated 12/12/49.*

	Percentage germination *Per cent*	Final stand at harvest *Per cent*
Dobbs	77 ...	98
P. 41	76 ...	97
E. Hegari	71 ...	97
D. Shallu 5463-34 ...	75 ...	97
D. Shallu 5463-37-3 ...	67 ...	98
D. Shallu 5631-12 ...	72 ...	97
Plainsman	69 ...	95

Gaps re-sown on 22/12/49.
Thinning and transplanting: 14/1/50.
Weeding: 11/1/50, 20/2/50.
Harvesting: P. 41, Early Hegari, Plainsman, 1st Harvest 1/1/50.
P. 41, Early Hegari, Plainsman, 2nd Harvest 26/4/50.

Dobbs and D. Shallu varieties: 26/4/50. Harvesting dates are again no reliable indication of length of maturity.

Grain yield of 1st harvest only of P. 41, E. Hegari and Plainsman

	lb./acre
P. 41	1,035
E. Hegari	900
Plainsman	1,120

Experiment III: Time of planting

Germination	*Thinning*	*Weeding*	*Harvest P. 41—E. Hegari*	*Dobbs*
Dec. 30/12/49 ...	25/1/50 ...	21/2/50 +	4/5/50 ... 4/5/50 ...	5/5/50
Jan. 27/1/50 ...	24/2/50 ...	21/2/50 +	4/5/50 ... 29/5/50 ...	29/5/50
Feb. 26/2/50 ...	17/3/50 ...	4/5/50 ...	... 4/7/50 ...	4/7/50
Mar. 24/3/50* ...	14/4/50 ...	4/5/50 ...	... — ...	—

*Approximate. The planting and germination dates of the March planting are correct to within a few days. The remainder are exact.

The harvesting of this experiment was unsatisfactory, in that the P. 41 and Early Hegari were left standing in the field after they were ready. There was no sign of grain loss, and this is unlikely to have affected the results. The stand was good in all plots for all times of planting, but no count was made.

Experiment IV: Weeding trial.

Planted 29/11/49. Thinned 14/1/50. Harvests 29/5/50.

No stands count, but stand good in all treatments.

Experiment V: Reinforced Compost

Planted 2/2/50 ... ... Germinated 6/2/50 *Manured*
Thinned 3/3/50 ... ... Weeded 7/2/50* 25/1/50
Harvested 5/7/50. 20/2/50, 15/3/50

	Stand count
Control	92%
Superphosphate	93%
Compost	92%
Compost-Super (heap)	95%
Compost-Super (drill)	92%

Straw weights (lb. acre)

Control	*Triple super*	*Compost*	*Compost-Super (heap)*	*Compost-Super (drill)*
2,150 ...	3,490 ...	3,640 ...	3,580 ...	3,490

All treatments are better than Control at P. = 01. There is no difference between the treatments, which are much more similar than the grain weights.

Experiment VIII: Striga Trial

Planted 29/11/49	Germinated 12/12/49.
Thinned 11/1/50	Weeded (whole trial) 19/1/50.
Striga pulled in clean weeding treatment	28/2/50, 25/3/50, 11/4/50, 30/5/50.
Harvested 15/7/50.	

Experiment IX: Ridging v. Flat cultivation trial

Plannted 18/1/50. Germinated 24/1/50 (approximate records incomplete).

*This experiment was planted to millet in error. Dobbs was sown among the millet, and the millet removed on 7/2/50 when the Dobbs had appeared.

Thinned 28/2/50. Weeded 28/2/50. Date of second weeding not recorded.

Harvested 3/7/50.
Stand good in all plots.

Stalk weights (lb./acre)

	Flat	*Ridged*	*Per cent* *Flat*	*Ridged*	*Difference Significant at*
Bukura Mahemba	8,200	6,920	118	100	P.=·01
Dobbs	5,540	5,450	101	100	N.S.
P. 41	3,190	3,030	105	100	N.S.

The stalk weights are better for B. Mahemba on the flat, but only very slightly better for Dobbs and P. 41, whereas the grain yields of Dobbs and P. 41 show a big difference in favour of flat cultivation. The B. Mahemba probably did not have enough rain to give a good grain yield (the ratio of grain weight to straw weight is very high.), and the straw weights suggest there the difference between the grain yield of the flat and ridged plots would have been greater in a longer rainy season.

APPENDIX II

RICE TRIALS

Kahogo selection trial

Sown 16 12 49. Germinated 22-23 12 49. Transplanted 8 2 50. Flowered 13 4 50-2 5 50. (No difference in flowering dates between varieties).

Harvested : 30/6/50.

Variety trial

Sown 15/12/49. Germinated 21-22/12/49. Transplanted 15/12/50-

Variety	*Flowering date*	*1st harvest*	*2nd harvest.*
2/16	11/4-16/4	29/6	22/7
Afaa Mwanza	13/4-26/4	29/6	22/7
Afaa Mkoma	10/4-27/4	22/7	—
Kalyamani	9/4-26/4	29/6	22/7
1/18	27/4- 6/5	22/7	4/9
Kahogo	14/4-23/4	29/6	22/7
B.C. 65	12/4-22/4	29/6	22/7
2/5	9/4-20/4	29/6	22/7

Residual Manurial Trial

Sown 16 12 49. Germinated 23 12 49. Transplanted 1 2 50. Flowered 7/4/50-18/4/50 (no difference between treatments). Harvested 16/6/50.

Yields

Treatment	*Grain lb./acre)*	*Percentage*
Cassia 4 tons/acre	3,630	100
Tree Cassava 4 tons	3,560	98
Cassia 2 tons	3,480	96
Tree Cassava 2 tons	3,720	102
Physic Nut 2 tons	3,870	107
Pen Manure 4 tons	3,940	108
Puddled only	3,670	101
Control	3,630	100

Owing to a misunderstanding the straw weights were not taken, but no growth differences were observed, and it is most unlikely that differences would have been appreciable in the straw weights.

Initial Effects. Trial I

Sown 30/12/49. Germinated 5/1/50.
Manure applied 18 and 20/2/50. Transplanted 23 and 24/2/50.
Flowered 10/4-27/4/50. (No differences between treatments). Harvested 10 and 12/7/50

Trial II

Sown 3/1/50. Germinated 10/1/50. Manure applied 22/2/50. Transplanted 23 and 24/3/50
Flowered 7/5-20/5/50. (No differences between treatments). Harvested 8, 9 and 10/8/50

Time of puddling in of green material

Sown 3/1/50	10/1/50
Manure applied 28 days treatment	15/2/50
Manure applied 14 days treatment	1/3/50
Manure applied 1 day treatment	15/3/50

Transplanted 16/3/50. Flowered 2/5/50-14/5/50. (No differences between treatments). Harvested 2 and 4/8/50.

Weeding trial

Sown 30/12/49. Germinated 5/1/50. Transplanted 16/2/50. Flowered 17/4-27/4/50 Harvested 3/7/50.

Weeding dates

	Only	*2 months*	*Continuous*
Early	27/2/50	... 27/3, 6/4, 5/5/50	... 27/2, 6/4, 5/5, 10/6/50
Late	18/3/50	... 18/3, 6/4, 5/5/50	... 18/3, 6/4, 5/5, 10/6/50

Variety × Spacing × Clump Planting Trial

Sown 16/12/49 Germinated 23/12/49 Transplanted 7/2/50

Variety	*Flowering date*	*1st harvest*	*2nd harvest*
Pishori	5/4- 7/4/50 ...	16/6/50 ...	3/8/50
Kahogo	13/4-24/4/50 ...	3/7/50 ...	—
Gamti	18/4- 2/5/50 ...	3/8/50 ...	—

General

The year has been one of progress and the building up of the Soil Conservation Service. Towards the middle of the year a number of appointments brought staff almost up to the approved establishment and this, coupled with additional equipment and the gaining of experience in the field, permitted a very fair output of work during the latter half of the year.

Except for work on non-native lands, the aim of the Soil Conservation Service is to give every assistance possible to district and other staffs in furthering soil conservation work, but, except for special areas coming under development and rehabilitation schemes, the progress of obtaining proper land use and applying soil conservation measures is not satisfactory.

Where the rate of deterioration is not too rapid, time can be taken to educate the people and enlist their full co-operation in dealing with the problem, but in many areas in the Territory the rate of deterioration is so rapid that irreparable damage is resulting and immediate action is required. Without a realization of this problem of accelerating progress, and a full appreciation that the natural resources of the Territory must be properly used, and that this work has the highest priority, future work will be more difficult. Evidence obtained by Soil Conservation staff during the year shows that a number of areas, if treated in their early period of use, could have been protected by simple practices and measures, but now, because of the progress of soil erosion, deterioration of forest and grass cover, major works are required expensive in money and man-power, and these to check further deterioration only, restoration to the original state being impossible.

Experience during the year has shown that even when plans and treatments of problem areas have been drawn up and agreed to the time-lag in getting them applied is very long, and unless special staff are made available to direct field work such measures are only too often inefficiently applied. The conservative ideas of many native cultivators have proved a great difficulty and the present approach of barazas, demonstration plots and Native Authority rules, etc., are still too often failing to convince the people. However, the recent use of colour film slides as a visual aid has proved of value, but, until we can develop greater skill in education and propaganda, resistance to controlled land use and soil conservation practices will continue.

Soil conservation work on non-native lands is at present limited only by staff and equipment. The response of estate owners and farmers has been most gratifying, and, during the year, a considerable part of the staff has been employed on non-native lands, simply because there was an immediate demand for such services, a willingness to treat lands, and to expend considerable sums of money in having this work done.

The problem of serious soil erosion on a number of estates has only arisen in recent years, mainly because of the greater areas brought under cultivation to meet demands for production, and the higher market value of crops. That active steps are being taken to meet the hazard of soil erosion augurs well for the future. Unfortunately there are a number of cases where bad land use is evident; in some cases ignorance of tropical conditions on the part of new settlers is the cause: in others there are the "hard cases" who have no thought for the future of the land. As most of the time of the service has been taken up in assisting the willing farmers, no action has been taken against the others, but in future steps must be taken to obtain proper land use, either by obtaining powers under the Natural Resources Ordinance or under the terms of the land leases.

Soil Conservation Centre, Tengeru

Good progress was made in developing this Centre, but a great deal still remains to be done. During the year three sets of European quarters were built by Soil Conservation staff, a number of buildings taken over from the Polish Camp were repaired and altered to provide accommodation for trainees attending courses at Tengeru, both African and European, and for African staff. The latter buildings are mostly of a temporary type and will have to be replaced by permanent buildings at a later date. This will require the building of hostels and labour lines.

The fact that there are still a number of refugees in the Camp, and that the taking over of land for the Natural Resources School has yet to take place, precludes the final clearing up of all the old Camp buildings and the final layout and full development of the Station.

Land became available for the carrying out of field work in March, and although there was little time before the advent of the rains, a number of trials, observations and demonstrations were laid down. Most of these were on the steeper slopes of the trial area, and dealt with the problems of different systems of hillside cultivation.

Eight observation plots of different systems of hillside cultivation were laid down.

A series of bench terraces with vertical intervals of 1'—6' were made, the time to construct being taken, and the effect on yield of the deep cut at the large vertical taken.

A replication experiment was laid down on a twenty-five per cent slope, comparing three treatments: made bench terraces, formed bench terraces, and the local native practice of providing no protective measures.

A trial of formed bench terraces, drained by providing a forward slope as well as grade along the terraces, was started on an area of moderate slope, twelve per cent in order to find a treatment to replace narrow base contour banking which is not popular with native cultivators, or efficient as a soil conservation practice.

A large area was bench terraced as a demonstration area, and used for the planting of a wide range of plant introductions and testing of local material.

A greatly expanded programme of investigations for next season was drawn up, and preparations and layout of the new areas started.

The bulking up of planting material and seed of a range of plants useful in soil conservation work was carried out, and a large amount of materials issued to works in the field.

The extension of this work was carried out in co-operation with departmental field staff in the Arusha and Mbulu districts and a number of demonstrations were laid down at various centres.

A forest nursery was established and seedlings of a range of trees and hedging plants for use on the Station and for issue were raised.

Research and Demonstration

A greater part of soil conservation measures applied in the field were based on U.S.A specifications, but on the steeper sloping lands there is a lack of information as to the most satisfactory treatments, and one of the first steps taken was to lay down observation plots of bench terracing at different vertical intervals. This was done in 1949 at Ol Turoto, Arusha, and were found very satisfactory. On land being made available at Tengeru further trials and observation plots were laid down and the following results obtained :—

Hillside Cultivation Plots

Treatment	*Yield per Plot in Lb.*
Matengo pit system (modified)	235½
Contour ridged and tied (5′ ridges)	220
Contour ridged (5′ Ridges)	204
Bench terraced (made benches)	187½
Bench terraced (formed with barrier hedges)	175½
Narrow base contour banks	152½

Cropped with maize, these plots all stood up to exceptionally heavy rains without serious damage, but the inter-bank erosion on the narrow base contour banks was considerable, and on steep slopes, in this case twenty-two per cent this treatment is not satisfactory. The bench terraced area suffered both from the disturbance of the soil (the benches were made only a few weeks before planting) and also from waterlogging during the prolonged rains, resulting in the maize at the back of the bench being much stunted in growth.

The value of ridge and ridge-and-tie cultivation, and the pit system, were accentuated in this season's long, heavy rains as they provided a raised area of well drained soil for the crop plants. One trouble with this treatment is the annual remaking necessary which, on the heavy loams of the Station is only little less than the making of permanent bench terraces.

Bench Terracing

Time of Construction and Yield Plots

Treatment	*Feet*	*No. of Man/Days to construct.*	*Yield Maize lb. per plot.*
Made bench terrace, vertical interval	1.	98	233
	2	116	246
	3	163	233
	4.	253	183
	5	218	150
	6	262	159

Steepness of slope and soil depth are the dominant factors controlling the design and use of bench terraces. At Tengeru the plot site for this trial was most favourable, having only a moderate slope of twenty-two per cent. and very deep soil, but, despite these conditions the results obtained from one year show that the large wide benches resulting from using a large vertical interval are expensive in labour to construct, and the deep excavation has a marked effect in this first year on yields.

On the other hand, benches with a small vertical interval have serious disadvantages such as giving narrow width of bench to work and large lengths of bench face to maintain under vegetative cover. For the set of conditions pertaining at Tengeru the 3ft. vertical interval is the most satisfactory, giving a 12ft. wide bench, little suppression of yields owing to soil movement, and moderate cost of construction.

Bench Terracing Trial

Three treatments were laid down :—

(a) Made bench terraces at two vertical intervals, six feet and three feet.
(b) Formed bench terraces using elephant grass barrier hedges at six feet and three feet vertical intervals.
(c) Native cultivation, no protective measures.

This experiment is designed to be run for a period of years, and from this first year, no real comparable results can be obtained, as the barrier hedges have not grown sufficiently to start to check soil movement and form benches, nor has the soil loss from the native method of cultivation proceeded far enough to affect yield, although loss of surface soil was very great. However, the yield of maize obtained from the three treatments show the suppression of yields due to soil disturbance on the made bench terrace in the first year.

	Comparative Yield
Plot	*Cropped Area*
(a) 70%	86%
(b) 84%	104%
(c) 100%	100%

Sloping Bench Terraces

In a year of heavy, prolonged rains, the obvious, serious effect on plant growth on bench terraces indicated the need for providing drainage, and a new trial was laid down of formed bench terraces with a slight forward slope,

provided with a graded ditch between each bench, and these stood up without damage under the first rain of 4·8″ in one night. It is considered that a design of this type would provide a replacement for the narrow base contour bank, even on gentle to moderate slopes, as the counter bank is not the answer in many native areas to soil erosion.

Observations were maintained on the Ol Turoto bench terraced plots which were laid down before land at Tengeru was available. On the formed bench terraces area the elephant grass barrier hedges planted at 6ft. vertical interval proved very efficient, and in two years two feet of soil has banked up the upper side of the barrier, which not only shows the value of this method where it can be applied, but also the great soil movement which took place on steep slopes. This, too often, happens unobserved when the soil moved is dispersed over the low lands or in streams and valleys. On the 3ft. vertical interval area the barrier hedges were only some 9ft. to 10ft. apart, and any crop grown between was badly suppressed by shade effect and competition for soil moisture. Only when barrier hedges are used on moderate slopes, or large vertical intervals adopted to give at least twenty feet horizontal distance between hedges, can elephant grass hedges be recommended.

Irrigation Layout

Preliminary investigation work was carried out before the final layout of trials was made. On both non-native and native lands bad irrigation methods are responsible for tremendous soil losses in the mountain areas and, as there is a wide range of crops, soil and degrees of slope to be considered, a number of different methods of irrigation are required. At Tengeru it has already been shown that velocities of flow normally recommended and used are too high for the fine, light soils, as the particles are very easily transported, and velocities of less than one foot per second must be used.

Systems of graded bench terraces, basin irrigation and border strip irrigation were tried out, and modifications to these are to be made, as any system recommended must be fool-proof in this country where the knowledge of the destructive power of flowing water seems to be practically non-existent.

Plant Trials and Introductions

In addition to testing indigenous plants considered of value for soil conservation work, a number of plant introductions were made, and, in this first year of test, some showed great promise.

Grasses

Andropogon intermedius and *A. Gischaemum*, introduced from the South Eastern States of America, proved to be medium sized bunch grasses, fine leaved, making a rapid growth and producing a big bulk of feed. As this is reputed drought resistant, and capable of spreading rapidly by "volunteers" it would appear worthy of extended trials in low rainfall areas.

Three of the Eragrostis species, *E. curvula*, *E. lehmaniana* and *E. chloromelas*, made good growth, but appeared to be tough and wiry and rather unpalatable to stock.

Paspalum virgatum, *P. dilatatum* and *P. notatum* were planted and the first two made excellent growth. *P. notatum* showed no value, having slow growth with small leaf production.

A range of species and strains of Setaria were received from Mpwapwa and all made strong growth, producing a big bulk of feed.

Two species, *Pennisetum salifax* and *Digitaria swazilandensis* were tried out as vegetative cover in waterways and on bench faces and are of definite value. The former, a rapid growing runner type, is of special value when large areas have to be covered, but it was found to be too vigorous in growth for planting on bench faces. On the other hand, *Digitaria swazilandensis* appears to be ideal for protection of bench faces, giving a low, close mat cover with a rate of growth not too rapid to be a nuisance in spreading into the cultivated lands, and to be fairly drought resistant.

Three species of grasses, a strain of *Giant Rhodes grass* (ex Sanya Juu), *Cenchrus ciliaris and Brachiaria brizantha* showed valuable properties, including considerable resistance to drought, and their best use appears to be for grass leys.

A number of strains or types of Cynodon were collected and planted in observation plots. The great variation in this strain is remarkable, and, once an easy method of planting big acreages is devised, much greater use can be made of the number of useful types isolated.

Other grass species planted in the observation plots showed no special value, or failed but, as much interest is shown in these plots by local farmers, the full range is being maintained.

Legumes

The purpose of observation work on this genus is to obtain a plant giving a satisfactory close cover which can be used for ground cover to carry over the dry season, and, secondly, as a soil builder. None have proved ideal as yet. The following species were tried out:—

Lespedeza Korean: Fair growth, but lacking in size and vigour.
Lespedeza Kobe: More erect growth, also lacking in size and vigour.
Lespedeza Common: Low close ground cover.

On the advice of the Plant Pathologist, Lyamungu, these are being tried again, using innoculated seed.

Tropical Kudzu, although making slow growth to start with, has produced a thick mat cover underlaid with a deep mulch of dead leaf, producing a large bulk of high protein feed.

Hubam clover, *Desmodium rensoni*, *D. uncinatum* and *Leucaena glauca* were all tall growing, deep rooted plants, giving little ground cover.

Alyce clover and Madrid sweet clover made fair growth, but failed to set seed.

A collection of indigenous legumes is being made in the hope that we can find something to meet our requirements.

Planting material and seed was issued for trial to a number of areas in the Territory, and, in addition, material was used by the Service in its field operations.

Education

With the completion of buildings and staff settling in, a limited amount of training and education was possible.

One of the first steps was the training of our field staff of African levellers and this was carried out by Mr. Taverner. The difficulties in doing this can be appreciated by the fact that, to obtain fifteen satisfactory men, some ninety-seven trainees were dealt with for different periods, but the time and trouble taken with these men proved its worth as excellent work has been done with three men, Raphael Ndekise, Gerrard Kifura and Anganfoon Angasa who have proved outstanding in qualities of leadership, keenness and exemplary conduct.

The efficient use of the mechanical units required the training of both tractor drivers and grader operators, and a special course in the technique of terrace construction was held at Nduruma Chini.

The preoccupation with field works limited teaching work, but during the year, one Agricultural Officer and eight Agricultural Assistants attended for periods of training at Tengeru, and, in addition, a number of African Agricultural Instructors were given short courses.

A constant stream of visitors come to the Station, a high proportion of which are shown the demonstration and soil conservation works. A number of parties of Chiefs from Moshi, and trainees from the K.N.C.U. Coffee School, Lyamungu visited the Station and were also shown work being done in the district.

Towards the end of the year a series of soil conservation films were lent to the Service by the American Consul General, Nairobi, and these were shown at meetings of farmers, at schools and to African audiences, and proved most valuable in stimulating interest and discussion on soil conservation matters.

Field Operations

The activities of the Service, in the main, are divided into two parts, first, the carrying out of reconnaissance work on both native and non-native lands, and the giving of technical advice and assistance and, secondly, where required, the construction of soil conservation works with heavy mechanical units on both native and non-native lands. The cost of such work precludes much being done on native lands except for special treatments.

In native areas a considerable amount of time was spent in examining lands and planting treatments in co-operation with other members of the Agricultural Department staff, and the Veterinary and Forestry Departments: the carrying out of this work was done by District staff.

On non-native lands detailed surveys are necessary before designs of layout of soil conservation measures can be drawn up, and some thirty estates were visited: in some cases detailed surveys were made, in others preliminary investigation only was done. These surveys required the following work to be done :—

(1) Levelling and check levelling of terrace lines	1,750 miles
(2) Plane tabling of special areas	3,600 acres
(3) Plotted traverses of farms	5,400 acres

The total acreage of those parts of the farms planned for treatment is over 13,000 acres.

Applications for assistance by farmers for the treatment of their lands greatly exceeds the capacity of staff and equipment to deal with them. The amount of work to be undertaken cannot be definitely stated until agreement between the farmers and the Service are signed, but it is estimated that the owners of some 20—25,000 acres in the Northern Province require the assistance of the Service in treating their lands.

During the first part of the year, January to March, only two heavy units were available, and during this period four farms were treated, requiring the construction of terraces on 677 acres, and the cutting of 23,400 feet of waterways and diversion ditches.

Further equipment was obtained during the year, bringing the number of heavy units to ten, and after the rains, and crops were harvested from the lands, the new programme was started. Up to the end of December a further eight areas were treated, totalling a terraced area of 2,219 acres. Diversion ditches and waterways totalled 24,200 feet. Realignment of farm roads to fit into the new layout totalled 2,000 feet. In addition, light equipment constructed narrow base contour banks on the Solian native area.

Total works completed by mechanical units

Terraces	4,382 acres
Diversion Ditches	43,000 feet
Waterways	4,200 feet
Farm roads, realigned and constructed	59,160 feet

New staff, both European and African, coupled with "teething troubles" of maintenance of the mechanical units, and difficulty in obtaining spares, affected the output of work, but, towards the end of the year a great improvement was shown, and it is estimated that by the end of the season, March, 1951, the equivalent of some seven thousand acres of terracing will be completed.

In addition to the straightforward work of terrace construction, etc., on farms, investigations and trials of different types of terraces to suit the wide range of soils and slopes were carried out. The extremely light, friable

soil such as found in the Ol Mtonyi area, with very high intensity rainstorms encountered, showed that standard specifications of terraces require modification.

Other investigations in the field have been directed to the construction of, and establishment of, cover in waterways. Where no suitable, natural waterways exists this has been a difficult problem. The obvious approach is to construct the waterways and establish cover the year before the terraces draining into them are constructed, but the urgency in protecting some lands requires immediate terracing. On one estate it was necessary to sod a long length of vital waterway, but timings and costings showed this to be uneconomic except for small critical lengths. Another waterway was protected by planting during the dry season, and irrigating. This proved satisfactory, and very much cheaper than sodding.

Operation of Mechanical Units

The standard heavy equipment of the Service is the Allis Chalmers HD5 crawler tractor with the No. 2 Preco Terracer, with light wheeled tractors such as the Ferguson and Fordson to operate ancillary equipment such as dump scrapers, disc terracers, etc.

At the beginning of the year two heavy units were on hand and these were fully occupied until March when the advent of the rains stopped work. With the approval of an expansion of these units, orders were placed, and eight additional units obtained. These were available at the beginning of the 1950-51 work season, September to March: costings of operation and work output were started and the end of March 1951 should permit of an analysis of their full work season's data.

Although the work output per machine has been good this has only been obtained by close supervision by European staff, as the extremely difficult working conditions of the Ol Mtonyi Basin and Loljoro (to which a greater part of the efforts have been confined) resulted in a high rate of breakages of machines and sickness of staff. Machines working in these areas are enveloped in a thick cloud of dust at all times. The one good soil area treated, Ngare Nairobi, showed the marked effect of soil type on work output. There, only seventeen cuts were required to construct a terrace, whilst in the Ol Mtonyi area at least twenty-three were necessary.

Some of the senior African staff have developed well and shown great keenness in their work and ability to take responsibility. There is every indication that, with further experience, they will be able to take charge of units operating in the field, with a consequent reduction in the cost of supervision.

On the field maintenance side the dispersion of units to widely separated areas to meet demands for work was unsound, and future planning of a programme of work requires a smaller number of units and larger groups. Towards the end of the year the posting of staff capable of organising the maintenance and repair work resulted in greater efficiency.

The difficulty of obtaining small plant and tools required for repair work was overcome, and the workshop equipment for Tengeru and certain mobile equipment was obtained towards the end of the year, and good facilities are now available for the annual overhaul of equipment during the heavy rains when field work is stopped.

D. Thornton,
Senior Agricultural Officer,
Soil Conservation

SUMMARY OF THE REPORT OF COFFEE RESEARCH STATION, LYAMUNGU, MOSHI

Weather Conditions

So far as the 1950 coffee crop was concerned the weather conditions were very favourable. Effective rains in January, 1950, brought a good second flowering and excellent rains in February and March resulted in good vegetative growth and swelling of the young cherry. During April and May the rainfall totalled forty-one inches and in each succeeding month until October appreciable rain fell. The rains of November-December, 1950, were insufficient to bring out all the flower bud.

The favourable conditions resulted in very rapid ripening and a large percentage of the crop had been picked by early November, although the percentage of the crop picked by mid-September was not abnormal.

Experiments

No additional field experiments were planted in 1950, no more land being available for this purpose on the station and the cleared land on Lyamungu Coffee Estate (the recently acquired extension) not yet having been brought into suitable condition. The off-Station trials of clones of the potential selections were extended, two additional squares being planted at Kibosho and one at Kirua, both in the Moshi district.

All existing experiments were maintained and the recording of the yields from these was completed by early December. Shortage of labour resulted in much of the coffee being picked when over-ripe, this may result in adverse reports in the liquoring of samples taken for this purpose.

The statistical analyses of the yields from the various experiments and trials of selections up to and including the 1949 season were completed.

These analyses showed that under the conditions existing at the Station the following treatments have resulted in a significant increase in yield—

(a) Banana trash or elephant grass as mulch at a rate of forty lb. per tree once per annum. These mulches are applied at the end of heavy rains, i.e. in June/July.

No advantage accrues as a result of increasing the quantities of mulch.

(b) Irrigation to the extent of making up the rainfall to the equivalent of two inches per month. No further increase in yield occurs by increasing the rate of irrgation.

(c) A combination of the irrigation and mulch (banana trash) treatments effects a still further increase in yield over and above that obtained by irrigation alone or mulch alone.

(d) The application of sulphate of ammonia at the rates of 2 oz. for the first three years after planting out, 4 oz. for the next three years and 6 oz. for the following three years. (The application of sulphate of ammonia at half these rates i.e. 1, 2 and 3 oz. respectively has not resulted in a significant increase in yield).

(e) Compost at the rate of one debe per tree. (This is not confirmed in a second experiment). Application of compost at double this rate has not effected a further significant increase.

(f) Pruning on the multiple stem system has resulted in a considerable increase in yield over that obtained by following the single stem system.

Over a period of twelve years, various methods of hand cultivation forked jembe, jembe, envelope forking and retaching have resulted in no significant increase in yield over that obtained by slashing the weeds just below ground level.

The trials of the clonal progeny of the potential selections have continued satisfactorily, the first series were planted in 1943 and although some of these have yielded at a higher rate than others in their early cropping years, it is necessary to collect further data before drawing any conclusions on their relative merits. Altogether the clonal progeny of seventy-four selections are on trial.

The results of eight years records of the seedling progeny of some of the potential selections are available and marked differences in cropping between the progeny of various mother trees occurs. With a view to further selection the recording of individual trees within the progeny plots of any of the more promising mother trees has been carried out.

The question of the relative merits of clones and seedlings of the same mother tree has not yet been decided—the two experiments in which clones and seedlings of the same mother tree are being compared have given conflicting results so far. A comparison of the physical characters of the bean produced by the clones and seedlings in one season showed no significant differences and over three seasons the bouoring classifications were the same.

The investigations into the suspected Boron deficiency in the coffee in the Mbosi district have been extended. In addition to the application of Borax to the soil, tree injections have been carried out and the effects of irrigation, with and without the application of borax to the soil, is being investigated. Leaf material from treated and untreated trees are being collected for chemical analysis.

The effect, if any, of these treatments will not be seen until early in 1951.

Vegetative Propaganda

Figures obtained previously have shown that losses by death after rooting were considerably higher with cuttings that had taken a long time to root than with quickly rooted cuttings. Moreover cuttings taken during the period October to February will not produce plants large enough to plant

out in the succeeding rains and will, for the most part, be rather too large to keep for a further year before planting out. Therefore the taking of cuttings was stopped in August, 1949 and not started again until early March, 1950. During the interval the majority of frames were cleaned out and filled with fresh rooting medium. Coconut fibre and sand was mostly used for the rooting medium.

During the year the percentage of cuttings rooted has been high and the time taken to root has been short. Moreover, the percentage of deaths after rooting was extremely low, especially during the period June to August. This has, apparently, been due to the availability of plenty of cuttings on the mother trees, so that only suitable ones had to be taken and also to the extended wet season with dull weather until the end of August.

A start was made with counting the number of cuttings obtainable from individual mother trees of various clones with the object of following up the rooting of these cuttings to ascertain the percentage survival.

Distribution of Planting Material

Two thousand five hundred and forty-two lb. of seed from the high yielding coffee selections was sold to growers and a total of 3,394 clonal plants were supplied to the Moshi Native Coffee Board and one planter for use as mother trees for the purpose of vegetative propagation.

Animal Husbandry

Selection for improved milk yield in the Zebu herd has been continued. All cows not having yielded 200 gallons in any one lactation, together with their progeny, have been culled.

The Sahiwal-Boran cross bull is effecting a considerable improvement in the herd both in milking qualities and in the size of the individual animals.

The total yield of milk for the year was 6,075 gallons. The highest yield in one lactation completed in 1950 was 363·5 gallons in 295 days given by Kaya in her eighth lactation. There were two cases of suspected trypanosomiasis early in the year and one instance of milk fever.

Lyamungu Coffee Estate

The clearing of the land on Lyamungu Coffee Estate has been continued. The areas cleared in 1949 were planted with maize followed by beans. The maize was ensiled and will be fed to the stock in the early part of 1951.

F. R. Sanders,
Senior Research Officer

LIST OF EUROPEAN STAFF AS ON THE 31ST DECEMBER, 1950

Director: C. E. J. Biggs, B.Sc. Dip. (Agric.) (Wye). Dar es Salaam.

Deputy Director: J. R. P. Soper, B.A. (Cantab). Dar es Salaam.

Regional Assistant Directors:

H. P. Smart, B.Sc., A.I.C.T.A., Dar es Salaam.
C. J. McGregor, C.D.A., Arusha.
A. H. Savile, C.D.A., A.I.C.T.A., Morogoro.
N. V. Rounce, C.D.A., A.I.C.T.A., Mwanza.

Senior Research Officer:

F. R. Sanders, B.A. (Hons.) Dip. (Agric.), Cantab., Lyamungu, Moshi.
G. W. Lock, O.B.E., N.D.A., N.D.D., A.I.T.C.A., Mlingano, Ngomeni.

Entomologists:

F. B. Notley, M.Sc., A.I.C.T.A., Lyamungu, Moshi. *
G. Swaine, B.Sc., Morogoro.
R. G. Tapley, B.Sc., Lyamungu, Moshi.

Plant Pathologist: G. B. Wallace, B.Sc., Ph.D., Lyamungu, Moshi.

Botanist: H. Doggett, B.A., A.I.C.T.A., Ukiriguru, Fela.

Senior Agricultural Officers and Agricultural Officers:

A. Pitcairn, Dip. Agric. (Edin.), Iringa. *
C. W. L. Fishlock, B.Sc., Mbeya.
R. B. Allnutt, B.Sc., seconded to Leeward Island.
D. Thornton, B.Sc., Tengeru, Usa River.
H. Gillman, B.Sc., M.Sc., A.I.C.T.A., Dar es Salaam.
J. K. Robertson, B.Sc., A.I.C.T.A., Tabora.
T. C. Cairns, B.Sc., Arusha.
J. T. Purvis, B.Sc., Malya.
E. T. Ward, C.D.A., on leave.
T. S. Jervis, Bukoba.
D. G. Jones, B.A., Dip.Agric.Sc., A.I.C.T.A., Lyamungu, Moshi.
M. Lunan, B.Sc., A.I.C.T.A., on leave. *
J. B. Clegg, B.A., Mwanza. *
R. W. Collett, on leave.
F. E. Luscombe, B.Sc., A.I.C.T.A., Moshi.
D. H. Drennan, B.Sc., Dip. Agric. (Cantab.), on leave.
H. L. Brett, Lindi. *
A. H. B. Childs, F.L.A.S., M.R.A.C., Kilosa. *
C. G. Clegg, Dip. Hort. (Wye), Dodoma. *
J. D. Hunter-Smith, B.Sc., A.I.C.T.A., Moshi.
J. S. Gunn, B.Sc., Dip. Agric. (Cantab.), Iringa.
W. G. Brookbank, B.Sc., Tabora.
A. Jefferiss, B.Sc., Lushoto.
N. E. S. Mutter, B.Sc., Lindi. *
C. C. Shapland, B.Sc., Dip. Agric. (Cantab.), D.T.A., Dodoma.
I. Constantinesco, B.Sc., Mbulu. *
A. Hamersley, M.B.E., B.Sc., Morogoro. *
G. K. Reake-Williams, B.Sc., Maruku.
C. G. Birch, B.Sc., Tengeru.
A. E. Carlaw, B.Sc., Musoma. *
M. J. W. English, B.A., Morogoro. *

Plant Physiologist: E. C. Dickmahns, B.Sc., Hons. (Glasgow)., Dip. Agric. Sc. (Cantab.), Ngomeni. *

Tobacco Officers:

J. H. McGregor, on leave.
J. M. Szymanski, Dip. Agric. (Wilno), Ngwina, Songea. *

Agricultural Officer (Ginnery): E. Drakley, Mwanza.

Research Officer: F. G. Smith, B.Sc., Tabora. *

Fisheries Officers:

G. J. Lockley, on leave. *
R. E. Gould, Korogwe. *

Principal, Indian School:

K. H. Advani, B.A., M.Sc., Morogoro.

Senior Agricultural Assistants and Agricultural Assistants:

A. A. E. Weirich, Tanga.
R. B. Silcock, Lushoto
B. R. D. Eccles, Lyamungu.
E. Pienaar, Kilwa. *
A. E. Favel, Bukoba.
F. Park, Ilonga.
D. H. Thwaites, on leave.
T. W. H. Dore, Arusha. *
D. Shepstone, on leave.
G. H. McGavin, Shinyanga. *
L. J. Lloyd, on leave.
J. I. Thomson, Kilosa. *
G. L. Goodhew, A.I.B.A.E., Utete.
R. C. Faun, Tengeru. *
V. C. Allen, Ngudu. *
R. C. Flint, Kibondo.
J. M. Van Dyk, Mahenge. *
T. E. Oliver, Kondoa-Irangi.
J. Little, Ukiriguru.
W. J. V. Jones, Ngudu.
A. J. R. Jenkins, Biharamulo.
R. G. Bickel, Ngomeni. *
R. A. Brown, Singida. *
W. I. Reece, Mpwapwa.
J. R. Bellamy, Geita.
J. H. Storey, Mgeta. *
H. W. Stubbings, Kwimba.
H. H. Sharpin, Ukiriguru. *
M. E. Sacre, Ngara.
A. W. Thompson, Ngomeni.
M. W. Tustian, Shinyanga.
M. S. Kemp, Biharamulo.
G. W. Pipe, Utete.
H. J. Gooding, Ukiriguru.
R. Duncan, Ukiriguru. *
D. Richards, Tengeru. *
P. G. Lewis, M.M., on leave. *
T. J. Taverner, Tengeru. *
V. Allen, Mwanhala.
J. C. Van Schoor, Tukuyu. *
J. V. Morris, on leave.
W. E. Yeo, Kigoma.
D. R. A. Goode, Iringa. *
K. Johansen. *
J. F. Tregarthen, Kisarawe. *
R. Simpson, Mbosi.
A. M. Pienaar, Bagamoyo. *
E. Hall, Same.
J. Colston, on leave.
K. H. Groves, Lyamungu.
L. B. Neary, Mahenge. *
A. Jackson, Mahiwa.
A. Priestner, on leave. *
S. D. Pyman, Kahama. *
H. E. Hubbard, Kingolwira. *
W. A. Dickson, Kilosa.
J. M. Ainley, Njombe.
B. J. Lumby, Songea.
F. W. Jollands, Ibindo. *
J. T. Leach, D.F.C., Tengeni. *
S. M. Clarke, Matombo.
H. E. Dickinson, Geita. *
D. F. Phillips, B.Sc., Sumbawanga. *
E. J. Richards, Same.
J. Papps, Korogwe.
D. C. Randall, Ukiriguru.
M. J. Routh-Herdon, Mwanza.
P. E. Chaplin, Tanga.
J. R. Tile, Mikindani. *
R. J. Newbury, Morogoro. *
C. L. P. Heath, North Mara. *

Executive Officers:

H. A. Wilkin, Arusha.
B. G. Ellison, Moshi.
P. L. A. Hill, Iringa.

Education Officers:

J. Hebenton, B.Sc., Ukiriguru. *
T. K. Parry, B.Sc., Dip. Ed., Morogoro. *

Temporary Scientific Assistant: Mrs. M. Wallace, B.Sc., M.Sc., Lyamungu, Moshi.

Horticulturist: L. M. Fernie, B.Sc., Lyamungu, Moshi. *

Office Superintendent: K. C. Pearson, Dar es Salaam. *

Stenographers:

Miss M. B. K. Rigg, Arusha.
Miss M. Knott, Morogoro.
Miss J. A. Masters, Dar es Salaam.
Miss A. M. Pollard, Lindi.

Mechanic: S. D. J. Tillott, Lyamungu, Moshi.

Soil Conservation Officers:

T. H. Evans, Tengeru.
J. D. Evans, Tengeru.

Mechanical Foreman: G. H. Bate, Tengeru.

Secretary/Typist: Mrs. M. Thornton, Tengeru.

* Served with Forces.

MONTHLY RAINFALL IN INCHES FOR SEASON 1949/50 AND YEAR 1950
PROVINCE AND PROVINCIAL STATIONS

	EASTERN Morogoro		CENTRAL Dodoma		WESTERN Tabora		LAKE Mwanza		SOUTHERN Highlands Iringa		NORTHERN Arusha		TANGA Lushoto		SOUTHERN Lindi	
	Ins.	Average 31 years Ins.	Ins.	Average 12 years Ins.	Ins.	Average 40 years Ins.	Ins.	Average 23 years Ins.	Ins.	Average 20 years Ins.	Ins.	Average 27 years Ins.	Ins.	Average 36 years Ins.	Ins.	Average 11 years Ins.
October 1949	0·06	0·91	0·00	0·25	0·27	0·55	0·99	1·89	0·12	0·22	0·01	1·37	0·48	1·28	0·44	0·51
November	0·36	2·15	0·00	1·51	1·17	4·14	2·26	4·77	0·05	1·65	0·98	4·40	4·44	3·84	0·36	2·39
December	2·03	2·76	4·80	3·09	5·91	6·64	12·37	5·25	2·20	4·87	4·50	4·08	3·21	4·41	4·54	6·13
		Average 32 years		Average 13 years		Average 41 years		Average 24 years		Average 21 years		Average 28 years		Average 37 years		Average 12 years
January 1950	3·40	3·92	6·80	5·17	4·21	4·91	2·16	3·66	4·94	7·02	3·42	2·27	3·07	3·01	3·90	6·00
February	3·93	3·69	7·37	3·27	5·59	4·96	2·83	4·27	4·12	4·94	1·61	3·43	1·03	2·96	5·54	4·10
March	8·68	7·22	6·73	4·94	8·38	6·68	6·72	5·99	6·98	6·99	13·56	6·93	5·37	5·79	8·70	6·20
April	8·61	8·23	0·29	1·57	2·05	5·31	7·88	5·44	0·98	3·47	26·22	14·36	10·94	9·15	7·03	7·11
May	3·85	3·84	0·05	0·14	1·50	1·09	2·61	3·69	1·04	0·53	10·54	8·08	6·46	7·25	0·94	1·40
June	0·35	1·16	0·00	0·08	0·00	0·12	0·12	0·68	0·00	0·04	0·70	1·37	1·60	2·16	0·14	0·35
July	0·34	0·55	0·00	0·00	0·00	0·00	0·44	0·58	0·00	0·00	0·63	0·55	1·20	1·37	0·92	0·32
August	0·24	0·38	0·00	0·00	0·00	0·04	1·06	0·83	0·00	0·02	0·35	0·80	1·56	0·85	0·15	0·21
September	0·93	0·65	0·00	0·00	0·02	0·29	0·47	1·86	0·52	0·10	0·02	0·87	0·51	0·68	0·04	0·59
Total for Season ...	32·78	—	26·04	—	29·10	—	39·91	—	20·95	—	62·54	—	39·87	—	32·70	—
October	1·46	0·88	0·21	0·23	1·98	0·54	3·79	1·85	0·15	0·22	0·21	1·33	1·59	1·25	1·73	0·50
November	1·23	2·09	0·03	1·40	1·19	4·07	3·28	4·67	1·64	1·57	1·31	4·28	3·11	3·85	0·38	2·22
December	1·22	2·74	2·47	3·22	9·26	6·62	5·40	5·55	2·78	4·75	0·97	4·09	1·66	4·38	4·93	6·00
Total for year 1950 ...	34·24	35·35	23·95	20·02	34·18	34·63	36·76	39·07	23·15	29·65	59·54	48·36	38·10	42·70	34·40	35·00

All figures quoted in above table are abstracted from Summary of Rainfall records for the years 1949 and 1950.
Part II—Tanganyika East African Meteorological Department.

EXPORTS FROM TANGANYIKA OF AGRICULTURAL PRODUCTS 1945 TO 1950

The following table shows the principal exports of the Territory since 1945 with the values of those for 1950

	Maximum output for export prior to 1950		1945	1946	1947	1948	1949	1950	Total value for 1950
			Amount	Amount	Amount	Amount	Amount	Amount	
	Year	Tons	Tons	Tons	Tons	Tons	Tons	Tons	£
Sisal	1942	136,237	110,637	111,521	95,856	117,092	132,541	118,909	11,846,057
Cotton Lint	1941	13,106	7,192	3,958	7,045	9,893	10,800	7,006	1,443,401
Coffee	1935	18,588	14,441	10,021	13,858	11,268	12,040	14,991	3,471,069
Groundnuts	1936	22,786	955	475	3,534	3,129	838	75	4,275
Sunflowers	1949	5,228	–	–	–	2,298	5,228	8,911	358,182
Copra	1928	9,318	5	312	40	48	3,585	886	42,198
Sesame	1938	5,241	1,441	929	493	928	6	–	–
Rice	1938	17,965	2,171	70	2,615	6,450	1,547·6	30	620
Millet and Sorghum	1928	7,732	3,804	315	4,741	1,914	74·5	1½	18
Maize	1948	3,070	20	–	1,875	3,070	105	7	50
Beeswax	1948	905	795	732	410	905	525	315	114,689
Honey	–	–	–	–	–	–	–	1	43
Hides and Skins	1947	4,609	2,259	3,527	4,609	3,310	4,059	5,471	1,377,539
Sugar	1941	5,454	1,130	315	838	568	5	2	92
Gums (Copal and Arabic)	1944	2,567	1,712	1,540	1,554	1,490	878	110	8,823Copal
								2,318	128,039Arabic
Ghee	1942	1,385	249	327	44	272	54·9	27	5,560
Wheat	1945	4,511	4,511	324	–	–	0·7	0·3	5
Tobacco (unmanufactured)	1948	1,421	935	924	667	1,421	1,073	1,130·5	232,823
Rubber	1944	1,314	2,320	1,019	49	54	18	8·4	1,455
Tea	1946	625	400	625	446	462	427	484	89,668
Vegetable oils (Coconut and Groundnut)	1940	2,268	1,801	1,009	900	1,463	933·1	1,400	132,955
Papain	1948	130	101	100	109	130	119·8	19·6	27,225
Onions	1948	2,418	1,849	1,925	1,754	2,418	275	296	10,848
Pyrethrum	1945	697	697	668	241	170	141	175	53,179
Fats, including substitute for Ghee and Butter	1944	1,247	650	783	71	1,689	6	20	2,061
Mangrove Bark	1942	7,291	4,927	5,490	3,408	–	1,446	857	12,236
Wattle	–	–	–	–	–	–	–	1,976	49,806
Cashew Nuts	–	–	–	–	–	–	–	6,532	203,554
Castor Seed	–	–	–	–	–	–	–	3,302	126,043
Kapok	–	–	–	–	–	–	–	653	138,939
Palm kernels	–	–	–	–	–	–	–	323	15,946
Beans and pulses (including seed)	–	–	No figures available					8,078	322,227
Cassava	–	–	–	–	–	–	–	142	2,061
Essential oils (in lb.) :									
(a) Lemon grass	–	–	–	–	–	–	–	1,543lb.	927
(b) Orange grass	–	–	–	–	–	–	–	18,828lb.	10,101
(c) Geranium	–	–	–	–	–	–	–	75	136
(d) Others	–	–	–	–	–	–	–	1,559	1,247
Total	–	–	165,002	146,909	145,157	170,451	176,726·6	184,467	20,234,097

LIST OF PUBLIC GINNERIES LICENSED IN 1950

Province and District	Locality	Number of Gins		Licensees
		Saw	Roller	
Eastern :				
Morogoro	Morogoro	—	22	Tanganyika Cotton Co., Ltd.
Morogoro	Mikesse	—	20	Ladaks, Ltd.
Morogoro	Ngerengere ...	—	11	Liverpool Uganda Co., Ltd.
Morogoro	Duthumi	—	20	Tanganyika Cotton Co., Ltd.
Morogoro	Turiani	—	16	Tanganyika Cotton Co., Ltd.
Kilosa	Kilosa	—	18	Kilosa Ginnery, Ltd.
Kilosa	Rudewa	—	22	Tanganyika Cotton Co., Ltd.
Kilosa	Msowero	—	16	Msowero Ginnery, Ltd.
Bagamoyo	Mandera	—	20	Liverpool Uganda Co., Ltd.
Rufiji	Kilimani	—	12	Rufiji Ginneries, Ltd.
Rufiji	Msomeni	—	15	Rufiji Ginneries, Ltd.
Rufiji	Logeloge	—	12	Rufiji Ginneries, Ltd.
Ulanga	Kiberege	—	16	Ulanga Cotton and Rice Industries Limited.
Ulanga	Malinyi	—	12	Ulanga Cotton and Rice Industries Limited.
Lake :				
Mwanza	Mwanza	—	28	Nakasero Commercial Corporation, Ltd.
Mwanza	Murutunguru ...	—	24	Ukerewe Cotton Co., Ltd.
Mwanza	Ihale	—	—	Mwanza Cotton Trading Company, Limited.
Mwanza	Bukumbi	—	18	Bhagwanji Sunderji and Company, Limited.
Mwanza	Nassa	—	20	Sikh Ginners.
Mwanza	Buchosa	—	14	Buchosa Cotton Co., Ltd.
Kwimba	Pambani	—	17	Pambani, Ltd.
Kwimba	Nyambiti	—	26	Kwimba Ginneries, Ltd.
Musoma	Mugango	—	20	Musoma Industries, Ltd.
Maswa	Malampaka ...	—	12	Bhagwanji Sunderji and Company, Limited.
Maswa	Luguru	—	15	Bhagwanji Sunderji and Company, Limited.
Shinyanga	Usogore	—	14	Bhagwanji Sunderji and Company, Limited.
Northern :				
Moshi	Moshi	—	24	Moshi Trading Co., Ltd.
Southern :				
Lindi	Mtua	—	14	Kikanda Cotton Trading Company, Limited.
Tunduru	Tunduru	—	14	Kikanda Cotton Trading Company, Limited.
Mikindani	Mikindani	—	5	Mikindani Cotton Company, Limited.
Tanga :				
Korogwe	Korogwe	—	26	Moshi Trading Co., Ltd.
Handeni	Sindeni	—	11	Moshi Trading Co., Ltd.